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2023 AgriResearch Conference

Knowledge, Innovation and Skills for Sustainable Horizons

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Conference Report

Agriculture and Rural Development

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Foreword by Janusz Wojciechowski, European Commissioner for Agriculture

It is my pleasure to provide you with the report of the third edition of the EU AgriResearch Conference.

The conference takes place in a time when agriculture, forestry and rural areas are at the crossroads: they must become more productive, competitive, resilient and sustainable than ever before. Research and Innovation (R&I) is key to drive progress in each of these areas. That is why R&I forms an integral part of the Common Agricultural Policy (CAP). That is why we have built R&I actions into the Farm to Fork and Biodiversity Strategies, as well as the Forestry Strategy and the Soil Strategy. And that is why R&I is at the heart of our Long-term Vision for Rural Areas, accelerating stronger, more connected, resilient and prosperous rural communities.

The first edition of the EU AgriResearch Conference in 2016 was instrumental in the design of our long-term strategic approach to EU agricultural R&I. The voices heard at that conference, and at the second edition in 2018, have inspired and guided R&I programmes in agriculture, forestry, and rural areas across the EU. I am proud of what we have achieved together since then, by leveraging the strengths and synergies of two flagship EU policies: the Horizon programmes and the CAP.

Those strengths and synergies have been made possible by **putting farmers, foresters and rural actors at the centre of R&I activities, co-creating solutions and exchanging knowledge with them, where they live and work, on farms, in forests and in rural villages**. We are also pooling our strengths through R&I partnerships with EU and Associated Countries, the private sector, foundations and other stakeholders. We do this to accelerate farming systems' transformation, with a focus on upscaling agroecology, on improving animal health and welfare, and on enhancing the potential of data and digital solutions in agriculture.

We have also innovated the way we programme R&I by launching the **Mission 'A Soil Deal for Europe'** more than two years ago. In this Mission, we have set the ambition to establish 100 living labs and lighthouses, with more than a thousand local experimentation and testing sites, all over Europe. Through these actions, we aim to lead the transition towards healthy soils by 2030. But we did not start with Horizon Europe: we have taken comprehensive R&I actions over the last decade and now we see the results on the ground, with plenty of innovative solutions and new knowledge ready to use in practice by farmers, foresters and rural actors.

It has been rewarding to hear from you during the conference on what our R&I priorities for the future should be and to learn how R&I can deliver promising solutions to tackle European and global challenges. During two stimulating days, you have engaged in **truly creative discussions and generated new ideas on how EU R&I can accelerate the sustainability transitions in agriculture, forestry and rural areas**. Your views, outlined in this report, will help to shape future R&I agendas, which will provide farmers, foresters and rural communities with the right knowledge, skills and innovation for sustainable horizons.

Yet, the conference is not the end, but rather a beginning. It begins the process of planning the last years of Horizon Europe. It begins our work in paving the way to the next EU R&I framework programme and the CAP. And by carrying on the creativity and cooperation of the conference, we can spark the beginning of a more productive, resilient and sustainable future for our farming, forestry and rural areas.

Executive Summary

The 2023 AgriResearch Conference was organised by the Directorate General for Agriculture and Rural Development of the European Commission and hosted in Brussels on 31 May and 1 June. This was the third edition of the Conference, for which the theme was "Knowledge, innovation and skills for sustainable horizons". The event gathered more than 500 participants – including scientists, entrepreneurs, policymakers, industry representatives, advisors, policymakers, farmers and representatives from non-governmental organisations - who discussed the future of EU Research and Innovation (R&I) in agriculture, forestry and rural areas.

During the **first day of this conference**, three plenary sessions were convened. Those plenary sessions reflected on how R&I in agriculture, forestry and rural areas can effectively support EU policy priorities, implement the global agenda for sustainable development and enable farmers, foresters and rural communities to address challenges in a global context.

The first panel discussed the topics **supporting EU policy priorities for the future** and addressed the 'triple challenge' of food systems (ensure food security, provide livelihoods for farmers and reduce emissions). Panellists highlighted **R&I as key for the transitioning to a future-oriented agriculture**, with R&I contributing to ensuring that the **green transition is just for all**. The need to **make sufficient investments in R&I and deliver solutions that can be implemented by farmers in the field was noted as crucial**.

The panel reflecting on **R&I to implement the United Nations' agenda for sustainable development** stressed the expected delay in delivering towards the Sustainable Development Goals (SDG). It was highlighted that **SDGs remain an appropriate framework to address global, regional, and local challenges**. A number of reasons for having so many SDGs off-track were highlighted by the panellists, including insufficient financial investments in R&I and the need for a consistent advocacy for agriculture and soil in international fora. To get back on track, **furthering investments in R&I, a stronger science-policy interface, the closing of the science-practice gap and ensuring that no one is left behind are needed**. Moreover, fostering international collaborations, sharing best practices, coordinating research policies, promoting capacity building initiatives are key to achieve sustainable, resilient agri-food systems and to improve nutrition for all. Panellists agreed that key requirements to deliver impact on the ground include: more applied research; innovation in relation to problems arising in practice; and direct, bottom-up co-operation between farmers, foresters, rural actors and scientists.

The third panel of the plenary sessions discussed **how R&I can enable farmers, foresters and rural communities to become more resilient, sustainable and climate smart**. The session outcomes highlighted the **importance of having the right questions asked to researchers and innovators** to deliver the R&I relevant for the transition to sustainable food systems. Placed based, bottom-up R&I tools such as **agroecological or soil health related living labs and lighthouses are key to put innovative solutions in the hand of the farmers**, facilitating encounters and innovation and knowledge co-creation among stakeholders. To nudge farmers, solutions have to be easily implementable and economically relevant. Panellists noted that in order to support the scaling up of agricultural practices that are truly regenerative, business as usual is no longer viable and knowledge gaps need to be addressed quickly and in different ways.

During the **second day of the conference**, **breakout sessions were convened around areas** where R&I can contribute to delivering on sustainable and climate-smart agricultural and forestry systems and

enable a people-centred green and digital transition. Participants were inspired by keynote speakers on the main challenges and opportunities where R&I can make a change. They also heard from the Commission on key EU R&I developments in those areas. Dedicated panels of experts framed the **co-creation exercises that followed, where participants on site had the opportunity to contribute to identifying future R&I needs in those areas**. The points harvested from the co-creation can be summarised around ***what*** are the R&I needs and ***how*** those needs can be delivered through R&I and related activities.

Regarding the ***what,*** participants noted that solutions are needed to enable a **climate smart and biodiversity friendly agriculture**. R&I is needed to evaluate the impact of possible solutions to address the climate and biodiversity challenges, the economic and social sustainability, assess their trade-offs and the impact of 'no action'. For climate adaptation, the importance of delivering on soil health related solutions was highlighted. To **foster the sustainable management of land, soil, water and nutrients,** a more integrated, soil-water nexus management of those natural resources in crop production is needed, including robust impact monitoring and risk assessment. The Mission 'A Soil Deal for Europe' was pointed out as the central EU instrument to provide support to key soil stakeholders. In order to **ensure healthy, sustainable and resilient cropping systems,** further research is needed on crop biotic and abiotic stress to develop resilient varieties. Furthermore, R&I needs to continue identifying efficient alternatives to synthetic agricultural inputs. To **ensure healthy, sustainable and resilient livestock systems**, innovative intervention approaches on animal health and welfare are needed, with R&I on standardisation and modelling of improved data collection systems including for livestock systems. R&I can help to build scenarios for future-proofed sustainable livestock production and deliver knowledge and solutions regarding feeding optimisation, breeding or individualised animal management. To deliver on the **sustainable management of forests**, R&I is needed to understand resilience of forests in relation to increasing extreme weather events. Understanding the role of sustainable forest management in human health and climate change can help delivering solutions to address major megatrends such as depopulation in rural areas. There is a need for R&I that delivers on new **rural opportunities** through narratives that can improve the societal perception of those territories and valorise their cultural and natural heritage. R&I is also needed for identifying triggers that have the potential to retain and attract young generations to rural areas. R&I that focuses on new job opportunities and skill development can contribute to tackling the challenges of rural areas. Furthermore, R&I on **new farming, food and bio-based systems** can strengthen the position of farmers, foresters and rural actors in the value chain and provide innovative circular solutions in the context of the bioeconomy.

On the ***how***, there are opportunities to **foster sustainable approaches such as agroecology and organic farming at the farm and landscape levels** through holistic and integrated approaches, with multi-disciplinarity and long-term experimentation, and engaging all actors and scales (local to global) such as in living labs. Furthermore, **unlocking the potential of digital and data technologies** by increasing data interoperability and implementing data platforms and open data models is crucial. Artificial intelligence can enable delivering on concrete solutions and support better decision making. Enabling data sharing and ensuring capacity building among scientists and stakeholders on EU digital and data related legislation was noted as key. In order to **enhance knowledge flows and skills**, peer-to-peer learning and farmer- and community-led discussion groups at territorial level can provide the right set of tools to address concrete challenges. To speed up the impact of new knowledge and tools on the ground, there is an opportunity to connect different Horizon networks (thematic, advisory and

the EU wide knowledge reservoir) to the forthcoming partnerships on agroecology, on animal health and welfare, on agriculture of data and on sustainable food systems. Improving the multi-actor approach by focusing on communication and leveraging the role of living-labs across the EU can both contribute to ensure knowledge and skills are put in the hands of practitioners. A bolstered role for social sciences and humanities (SSH) in R&I activities, where SSH is key to deliver on the systems approach and support effective evidence-based policies and communication, **can be beneficial for strengthening the socio-economic performance of the sectors and modernising policies**. Fostering new business models and value chains is important to increase the attractiveness and the resilience and sustainability of the sectors. Last but not least, **strengthening international cooperation** on R&I on those areas that represent common challenges and opportunities among international partners can facilitate enabling solutions at regional and global scales and advance towards meeting the SDGs.

Further details on the ideas discussed during the breakout sessions can be found in dedicated chapters of this conference report.

The conference was closed with final remarks from the **Director General of Research and Innovation** and the **Director General of Agriculture and Rural Development of the European Commission**. The main remarks referred to the need for R&I to address planetary challenges that are connected to agriculture, forestry and rural areas and the importance of ensuring access to new knowledge and innovation by all farmers, foresters and rural actors.

A short ceremony followed with the signature of the **Mission Soil Manifesto** by both Directors General. The conference also included an exchange between the Directorate General of Agriculture and Rural Development of the European Commission with the Bill and Melinda Gates foundation on opportunities for international cooperation, and a final inspirational message from the Save Soil global movement.

31 May: Innovating with impact, what's next for research and innovation in agriculture, forestry and rural areas?

Introduction

Magda Kopczynska, then Deputy Director General of the Directorate General for Agriculture and Rural Development of the European Commission (Figure 1), opened the 3rd AgriResearch Conference and moderated the first day of the conference.

The **main conference objectives** were:

- ✓ To look at the changing context in which farmers, foresters and rural communities evolve and showcase how agriculture Research and Innovation (R&I) can enable the green transition and foster the resilience of farming, forestry and rural communities;
- ✓ To take stock of the implementation of the EU strategic approach to agriculture R&I and co-create the EU agenda for agricultural R&I;
- ✓ To identify R&I tools and skills needed by farmers, foresters and rural communities to foster sustainability in their sectors.

Magda Kopczynska laid out the elements of **the first day of the conference**: what R&I actions are needed to achieve the ambitions of the EU policies and the 2030 Agenda for Sustainable Development, and how to implement them to strengthen impact on the ground in the EU and globally. On that basis, discussions would identify how we can pursue our goals in the next years, how we can further structure and organise our work to deliver more for society. She highlighted that this should be done in partnership with public authorities, international partners, primary producers and other businesses, local communities and all those active in the innovation ecosystems.

Figure 1. Magda Kopczynska introduced the first day of the conference.

The second day of the conference was to be dedicated to recap what was achieved with EU wide R&I for agriculture, forestry and rural areas so far. Building on that, Magda Kopczynska noted that reflections would take place on concrete sectorial challenges with a systems perspective and co-create the priority R&I needs to address the environmental, social and economic sustainability challenges. Notably, participants would contribute to co-creating the R&I paths to: sustainable management of natural resources, in particular through the EU Mission 'a Soil Deal for Europe'; agrobiodiversity for healthy cropping systems; healthy and sustainable livestock systems; and multifunctional forests. Beyond this, participants would also reflect on the variety of skills, catalysers, and tools that can be

used to bridge the gap between science and practice and that can make a real difference on the ground. Attention would be given to digital and data technologies as well as social sciences. To ensure that no one is left behind, considerations should be given on the opportunities for rural communities to become stronger, connected, resilient and prosperous.

A small poster session was held during the breaks of the plenary sessions, showcasing results of EU R&I funded projects. The day after the conference there were **field trips to visit six local innovation projects of EIP-AGRI operational groups**, which the European Commission supports under the Common Agricultural Policy (CAP). Those visits were a unique opportunity for participants to experience how research and agricultural practice are working hand in hand for new innovative solutions and to exchange directly with practitioners.

High-level policy session: Research and innovation enabling sustainable transition in agriculture, forestry and rural areas

The high-level opening session set the scene of the Conference with speakers from the policy side and an inspirational talk by a researcher who gave the perspective of the future of agriculture. The session discussed the context, the challenges and the opportunities in which farmers, foresters and rural communities evolve. It provided the **EU policy view on how EU R&I supports the sustainability of farming, of forest activities, of rural areas and how it contributes to the achievement of EU objectives.**

The European Commissioner for Agriculture and Rural Development Janusz Wojciechowski (Figure 2) recalled that R&I is key to drive the adaptations that are needed by farmers, foresters, and rural communities to respond to the changing context. He stressed that farmers need help to be more productive, more competitive, resilient and sustainable. He noted that for the period 2021-2027 around 9 billion EURO are dedicated to R&I under Cluster 6 of Horizon Europe addressing food, bioeconomy, natural resources, agriculture and environment. This financial support has doubled compared to Horizon 2020. He noted that promising existing solutions supported by Horizon Funds are collected in result packs and are available for farmers, foresters and rural communities. The Commissioner also gave concrete examples of planned R&I cooperations through Partnerships between the European Commission and the Member States as well as Associated Countries, for example in the field of agroecology and animal health and welfare. He stressed that the EU is building alliances with third countries and gave the example of the new global initiative for conservation and sequestration of soil carbon. He recalled that Horizon Europe works in synergy with other funding instruments, importantly for Cluster 6 of Horizon Europe with the CAP. While Horizon Europe supports the setting up of advisory networks, the CAP invests in the setting up of the Agricultural Knowledge and Innovation System (AKIS) and in the European Innovation Partnership. He stressed that **farmers, foresters and rural communities are at the centre of the EU long-term strategic approach for agricultural R&I**. Hundreds of projects applying the multi-actor approach tested concrete solutions on agricultural and forestry lands. He noted the key relevance of the Horizon Europe Mission "A Soil deal for Europe" under which concrete solutions are experimented for restoring and maintaining soil health. He finally underlined the pivotal moment we are facing and called upon everybody's responsibility to act.

Figure 2. European Commissioner Janusz Wojciechowski during the opening speech of the conference.

"We do not simply undertake scientific research for farmers, foresters and rural actors, but with them" - Janusz Wojciechowski

Commissioner Wojciechowski's opening speech was followed by an inspirational talk delivered by **Rogier Schulte,** Chairholder in Wageningen University and Research on the future of agriculture (Figure 3)**.**

Figure 3. Rogier Schulte delivered an inspirational speech on the future of agriculture.

Rogier Schulte stressed the **difficulty to imagine how future agriculture will look like in the context** of climate change, war and supply chain disruptions. He noted that while the future of agriculture is hard to imagine, we know who will produce our food in 2040, who will take care of our lands and presented two examples of young farmers. The first entered into the farming business by generational succession. The farmer works with her mother on a dairy farm and would like to make some changes to make the farm more sustainable. **In 2023 she is still struggling to be taken seriously as a women farmer in a men's world.** The second, was an example of a new entrant who shifted carrier and who relies on rented land.

Rogier Schulte noted that young farmers are willing to make the changes for a more sustainable business but face many challenges to do so. He highlighted that the farmers he knows are not short of information, on the contrary. But it remains difficult to find the relevant information and knowledge in a given local context. Every day, 10 million farmers across Europe try to reinvent their farming system to be ready for the challenges. However, the **farmers need our help to succeed in overcoming the obstacles: financial, political, societal**. **Lighthouses and Living labs**, **that use co-learning, local adaptation and co-innovation as main concepts, can help overcome those obstacles.** He recalled that the Horizon Europe's Mission for soil health main tools are also the Living labs and Lighthouses: a great Initiative to make the change happen.

"The global network of lighthouse farms can illuminate the pathways of those that follows" - Rogier Schulte

Rogier Schulte asked the participants to change the perspective and to adapt the **"How can WE attitude".** How can we enable farmers to produce more with less? What can I do to facilitate the work of the farmer of the future? He addressed the following question to the participants: "How can R&I best help farmers, foresters and rural communities?" The 'word cloud' put upfront the need to share knowledge, foster agroecology, multi-actor approaches, listen to farmers, grasp complexity and develop new business models.

Peter Kullgren, Minister for Rural Affairs of Sweden and Chair of the EU Agriculture and Fisheries Council (Figure 4), provided the perspective from the ongoing Council Presidency after the experience of the first 5 months. He highlighted that **the potential of the agricultural and forestry sectors' contribution to sustainable transformation is high on the agenda**. He reported on the Presidency's work on Bioeconomy where Council Conclusions were adopted in April. He underlined that speeding up the development of sustainable and circular economy is important for dealing with today's challenges. Bioeconomy contributes to tackling climate change, it provides food and energy and creates jobs in rural areas. **He underlined the key role that R&I plays in the development of the bioeconomy and stressed the need to further support the uptake of innovation by farmers, which can be challenging especially for small and medium size enterprises**. Peter Kullgren noted that the latest CAP reform responds to the needs, providing the necessary instruments to tackle the challenges that the sector faces. The reinforcement of the cross-cutting objective on fostering knowledge and innovation in the CAP is a positive step, however Member States need flexibility to adapt the interventions to the local context. He underlined the complementarity between the CAP and Horizon Europe and pointed out that policy needs scientific evidence. R&I projects should not only consider economic and environmental sustainability but social sustainability as well. Peter Kullgren concluded by pointing out that **adaptation and transition need more targeted R&I.**

The next speaker was **Luis Planas Puchades,** Minister of Agriculture, Fisheries and Food, Spain (Figure 4), which took over the Council Presidency from Sweden in July 2023. He presented the main ambitions of the Spanish Presidency for the agricultural sector: to boost technologies within the agri-food sector, to ensure food security, food safety, health and the protection of environment. He further highlighted the role of the CAP for rural areas and to raise the visibility of the rural areas, promoting the conclusions of the Long term Vision for rural areas. He stressed that **R&I and new technologies in particular, are key to progress to a sustainable food system**. Luis Planas Puchades underlined the key importance of new genomic technics (NGTs) and digitalisation. He recalled that EC proposal on NGTs is expected for the summer, and the Spanish Presidency considers it crucial for developing new crop varieties that are more resilient to droughts and to new diseases. He announced the objective of getting a political agreement on this issue in the Council during the Spanish Presidency.

Figure 4. Left: Minister Peter Kullgren, Sweden; Right: Minister Luis Planas Puchades, Spain

Luis Planas Puchades underlined that R&I help to produce food more efficiently and consuming fewer resources, such as water, energy or fertilizers. He stressed the importance of knowledge development, innovation and technologies to help farmers adapting to climate change. He highlighted the importance of the **strategic autonomy** of the EU, especially in the context of the Russian invasion and war in Ukraine. Moreover, the green transition is needed, and it is urgent: It requires effort, and should be just for all. There is a need for better connecting the sustainability transition to farmers' challenges. The European Innovation Partnership for agriculture productivity and sustainability (EIP-AGRI) is a very good tool to deliver on farmers' needs. Spain greatly increased its supports to EIP-AGRI in its national CAP Strategic Plan. He finally recalled complementarity actions financed under Horizon Europe and Next Generation EU and stressed that R&I plays a key role in the transformation of the agricultural sector.

Norbert Lins, Chair of the Committee on Agriculture and Rural Development of the European Parliament (Figure 5), was the next speaker in the high-level opening panel. He started by highlighting that to tackle current and future challenges R&I is key in helping the transformation to a future-oriented agriculture. Additional efforts are needed to ensure that support reaches rural actors, especially farmers and foresters. He underlined that a number of initiatives help the necessary transformation, such as the CAP, EIP-AGRI, and Horizon Europe. He considers that the new CAP is a first step in the right direction for more environmental sustainability. He stressed the need for more money for facing the challenges: CAP and Horizon Europe would need additional financing. Norbert Lins noted that Digital transformation is also key, the need to invest more in the Space program and in precision farming. He highlighted the expectations that the European Commission presents its NGTs proposal in July 2023. After underlining the key question of communication and the role of advisory services to ensure innovation, he concluded noting that the involvement of farmers, connection between researchers and policy makers with other stakeholders is crucial.

"To tackle current and future challenges R&I is key in helping the transformation to a future-oriented agriculture" – Norbert Lins

Marion Jansen, Director of the Trade and Agriculture Directorate of the Organisation of Economic Cooperation and Development (OECD) (Figure 5), concluded the high-level opening panel by bringing OCDE perspectives into the discussion. She began her intervention by stressing the "triple challenge" of food systems: ensuring food security and nutrition for a growing global population of 10 billion people in 2050; providing livelihoods for more than 600 million farmers; and reducing emissions (food systems account for one-third of global emissions).

Marion Jansen explained that to achieve the UN's Zero Hunger sustainable development goal while keeping agricultural emissions on track to reach Paris Agreement targets, average global agricultural productivity needs to increase by 28% over the next decade - triple the increase achieved over the past decade. To support this, R&I is essential. She recalled that in late 2022, 50 Ministers and Vice Ministers of Agriculture met at the OECD to discuss these challenges and committed to a Ministerial Declaration on *Transformative Solutions for Sustainable Agriculture and Food Systems.* This OECD legal instrument commits, for example, to increase investment in research and development and infrastructure, enhance research collaboration and knowledge sharing and invest in research, innovation and extension services that can facilitate sustainable productivity growth and offer climate change mitigation and adaptation solutions.

Figure 5. Left: Member of the European Parliament Norbert Lins, Right: Marion Jansen, OECD.

Marion Jansen noted that the OECD has been leading work analysing and assessing the performance of agricultural innovation and sustainable agricultural productivity growth. The OECD Co-operative Research Programme, for example, funds researchers and networks and the OECD's Producer Support Estimate (PSE) tracks government spending on policies that support sustainable productivity growth (and those that don't). According to OECD estimates, in the EU resources devoted to agricultural knowledge and innovation, while above the OECD average, are still relatively limited as a proportion of the total support provided to the sector. Over the last 20 years, the OECD has seen a decrease in

overall spending on knowledge and skills, R&I and infrastructure. She finally stressed the need for increased investment in innovation that is targeted to enhance sustainable productivity growth to ensure the necessary transformation of food systems.

To conclude the discussion, panellists (Figure 6) were requested to reply to the question **"How can R&I best help farmers, foresters and rural communities?"** Norbert Lins asked for **more funding for R&I**; Luis Planas Puchades **asked for more money for R&I that reaches out to farmers so they can feel supported by society, the human dimension;** Marion Jansen underlined the **need for R&I solutions that can be implemented by the farmers on the field.**

Figure 6. Panellists and moderator of the first plenary session.

Research and innovation and Sustainable Development Goals: Are we on track for 2030? What's next?

This plenary session aimed to discuss the pivotal role of R&I in implementing the global agenda for sustainable development. The panellists reflected on how R&I in agriculture, forestry and rural development may enable the sustainable development agenda until 2030 and beyond. They shared experiences from different viewpoints on the most promising ways in which R&I can contribute to the SDGs by preserving and restoring soil health and transforming agri-food systems. EU progress towards the SDGs over the past 5 years is presented in Figure 7. Soil health, agri-food systems transformation, women and future generations empowerment were discussed under the prism of impactful R&I.

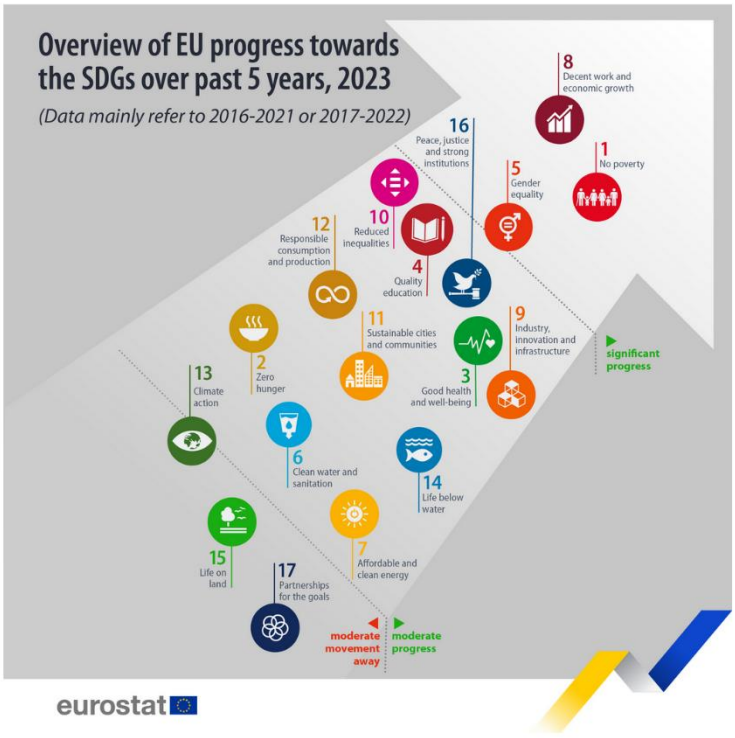


Figure 7. Overview of EU progress towards the SDGS over the past 5 years. Source: Eurostat

Ismahane Elouafi, then Chief Scientist of the Food and Agriculture Organization of the United Nations (Figure 8), set the scene for the panel discussion with a keynote presentation about the role of R&I to achieve the Sustainable Development Goals (SDGs). She rang the alarm about most SDGs being globally off-track30% of SDGs are either showing no progress at all or progress is regressing (Figure 9). Backtracking of SDG 2 on Zero Hunger is particularly alarming, with 2021 data showing a significant increase of the number of undernourished people - 150 million more hungry people compared to 2019 - a trend that is set to continue in the absence of systemic change.

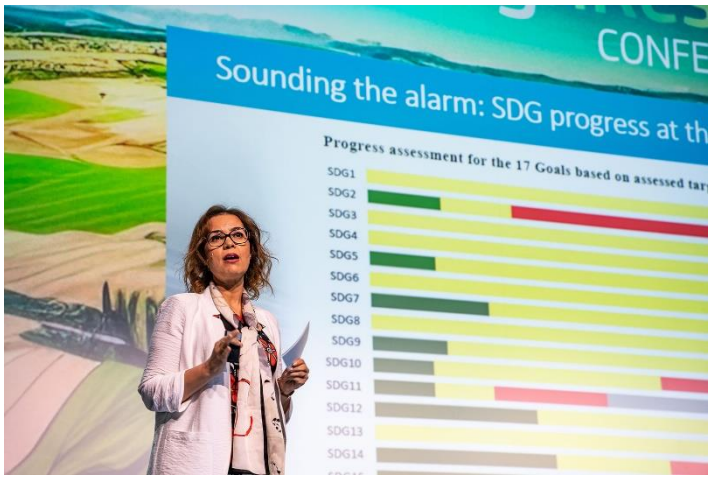


Figure 8. Ismahane Elouafi during her keynote speech on the role of R&I to achieve the SDGs

Ismahane Elouafi advocated for the urgent transformation of agri-food systems towards more efficiency, more inclusiveness, more resilience and more sustainability. She argued that science, technology and innovation can bring **opportunities** to accelerate this transformation. There are numerous **frontier technologies and innovations** that can be leveraged. Agri-food systems'

transformation requires innovative approaches, such as climate-smart agriculture, agroforestry and agroecology, organic farming, zero tillage. Sustainable soil management, gene editing technologies, biotechnology, digital technologies and agricultural automations offer opportunities to achieve the **dual aims** of producing sufficient food and safeguarding the environment. Working with the private sector is crucial to understand where we are in deploying technologies that are ready to use, for instance in the livestock sector.

Ismahane Elouafi highlighted the need for more **investments** in agricultural research and development, particularly from the public sector. She stressed the importance of partnership and complementarity between public and private investments, considering that the private sector has almost tripled its investments in agricultural R&I between 1990 and 2014 - with a focus on few commodities - and that public investment declined globally in the same period. She called for enabling policies with stronger **science-policy-society interface**. Last but not least, she drew the audience's attention on the fact that we cannot afford to leave anyone behind in achieving the SDGs, certainly not **women and young people.** Their needs and active participation should be given particular policy attention and investment, so that they have access to science, technology and innovation that will contribute to their empowerment. She concluded her intervention by highlighting three priority areas for R&I to enable the global sustainable development agenda: I) investments in frontier science; ii) deploying innovation in the global South; and iii) empowering under-represented actors: indigenous people, women and girls, and youth.

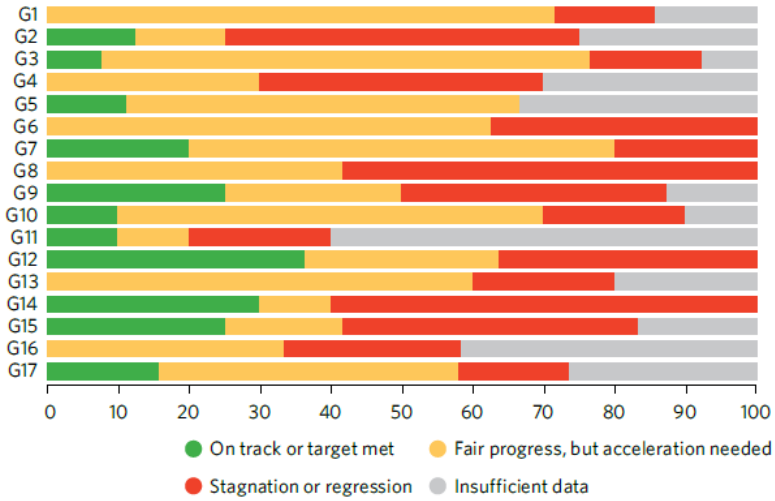


Figure 9. SDGs progress at the mid-way point. Progress assessment for the 17 Goals based on assessed targets, 2023 or latest data (percentage). Source: Isamahane Elouafi presentation

"Public investment in agricultural research and development is a key enabler for the global sustainable development agenda" - Ismahane Elouafi

Building from Ismahane Elouafi's keynote speech, five panellists with different expertise reflected on **what are the key challenges and opportunities for farmers, foresters and rural communities to be more sustainable, resilient and climate-smart.**

The Honourable Penny Wensley AC, National Soils Advocate of Australia, stressed the importance of soil health for achieving zero hunger and that more attention to soil is needed to achieve at least 11 of the 17 SDGs. The Australian example of an independent National Soil Advocate may inspire other countries to raise awareness on the importance of soil in policies related to agriculture, environment, energy, indigenous peoples as key enablers of the UN sustainable development agenda.

Elisabeth Claverie de Saint-Martin, CEO of the French Agricultural Research Centre for International Development (CIRAD), highlighted the urgent need to make progress on the UN sustainable development agenda. Agroecology as a driver of resilience of food systems and adaptation to climate change, offers a diversity of nature-based solutions to urgent challenges. Water and soil management, better use and conservation of plant biodiversity, post-harvest losses, value chains resilience, circular economy, one health issues and the role of consumers are key areas to address to achieve the SDGs. Besides, promoting more collaborative science at a global level, through globally funded long-term observatories and share of information and knowledge, are essential.

Alice Ruhweza, System Board Member of the Consultative Group for International Agricultural Research (CGIAR) and Africa Region Director for the World Wide Fund for Nature (WWF), highlighted the interconnection between the different SDGs. Well targeted R&I need to tackle the roots of hunger and malnutrition. Small-holding farmers need the right financial incentives to embrace innovation: their role is fundamental for a nature-positive, carbon-neutral and equitable future at the global level.

Diana Lenzi, President of the European Council of Young Farmers (CEJA), put the spotlight on the huge commitment shown by farmers and the civil society towards the SDGs. Farmers are in the centre of innovation deployment and young farmers play a key role in bringing new approaches and technologies on the ground. The financial aspects need to be considered: not only R&I has a cost, but farmers need to invest to deploy innovation and consumers need to reward this as well.

Teresa Pinto-Correia, Professor at MED-University of Évora, Portugal, and Vice-Chair of the Mission Board "A Soil Deal for Europe", highlighted the need for private and public food system actors to change their practices and increase their collaboration. Besides 'classical' R&I tools, novel approaches like the EU Mission 'A Soil deal for Europe' are key. What do we know about people managing soil? How do they make decisions? How to implement new business models? Which type of regulations are needed? Natural sciences and social sciences need to address this kind of questions to lead the transition towards healthy soils as a basis for sustainable agri-food systems.

Figure 10. Panellists and moderator of the second plenary session

The panellists (Figure 10) stressed the **delay in implementing the UN sustainable development agenda**, despite considerable efforts. **SDGs remain an appropriate framework to address global, regional, and local challenges**. Investing in R&I, fostering international collaborations, sharing best practices, coordinating research policies, promoting capacity building initiatives are key to achieve sustainable, resilient agri-food systems and improve nutrition for all.

When asked what is more urgent to advance on the SDGs, fundamental frontier research or innovation and applied research, panellists agreed that applied research, innovation around problems coming from practice, farmers working with scientists to deal with emergency situations, are key to deliver impact on the ground.

"If you take science to the farmer through living labs, your chances of getting to scale are higher" - Alice Ruhweza

Finally, when discussing the **top reasons for so many SDGs being off-track**, the panellists came up with a range of interconnected causes:

- Inequalities, conflicts and climate change.
- Not enough financial investments in R&I, not-people-centred policies, difficulty in scaling up to the last mile.
- Complexity, affordability and lack of visibility.
- Need for a consistent advocacy for agriculture and soil in international fora: farmers are not enough rewarded and recognised for their services, such as carbon sequestration.
- Weaknesses in showing the costs of inaction, for instance as regards soil fertility or reducing inequalities.

Research and innovation enabling farmers, foresters and rural communities to become more resilient, sustainable and climate smart.

EU farming, forestry and rural communities face challenges that are also driven by global trends. The pressing need to sustainably manage natural resources and external inputs in agriculture, absorb supply chain geopolitical shocks, address climate change and reverse biodiversity loss and foster rural resilience are key examples of those challenges. The EU, through the Green Deal, has committed to a sustainability transition, which for agriculture relates to many interconnected challenges and opportunities.

This plenary session aimed to reflect on the opportunities that R&I can offer to farmers, foresters and rural communities to address EU challenges in a global context: how to enable them to become more resilient, sustainable and climate smart in this context.

Sjoukje Heimovaara, President of Wageningen University and Research (Figure 11), set the scene for the panel discussion with a keynote presentation on the role of R&I in transforming agri-food systems. She noted that agri-food systems are both challenged by and a contributor to climate change and to the pressure on natural resources including use of fresh water and land.

Figure 11. Sjoukje Heimovaara keynote speech on the role of R&I in transforming agri-food systems.

R&I has three roles in any transformation to a just and safe world: to generate and share new knowledge, to design and develop new technologies, products and procedures, and to be an example of how to take steps forward coming from different views by learning from and respecting each other' views. For researchers and innovators contributing to the transformation of sustainable food systems, **the right questions need to be asked** of them. She recalled that research, innovation and education have greatly contributed to increase in production efficiency over the past decades, like in the case of the Netherlands during the 60's. She noted, however, that this increase in production efficiency has been accompanied by severe pressures on land and on natural resources. Pointing to the resulting new needs on knowledge, technology and procedures, she noted that the complexity of the transformation faced nowadays in the Netherlands, and similarly in the EU and globally, requires

collaboration across borders, disciplines, governments and greater coherence with international policies.

Sjoukje Heimovaara presented **the example of how reducing food waste and changing diets requires multiple perspectives**, including in R&I: need for new technologies, understanding consumer behaviour, developing new plant-based alternatives, addressing the role of livestock in sustainable and circular food systems, addressing correlations between food consumption and food production systems in the international context, and envisioning new profit and earning models for farmers.

There are **seven dilemmas that need consideration for researchers and innovators to deliver in the right direction** towards sustainable food systems:

- How will Europe contribute to global food security?
- How are we to achieve the climate and nature goals?
- Can we drive consumer behaviour, and do we want to?
- Do we separate or entwine agriculture and nature?
- What role does animal production play?
- What moral position do animals have?
- On what scale do we aim to resolve issues?

Sjoukje Heimovaara finally pointed out at **the third role of R&I** when providing facts and knowledge with confidence, explaining different angles, respecting each other's expertise. She concluded stressing that all stakeholders including entrepreneurs and farmers would need to contribute to the transition, and the key role of placed-based innovation.

"Let me close by calling all to action, take up our different roles, and do it with courage; let's co-create a sustainable future for all" - Sjoukje Heimovaara

Building from the keynote speech, five panellists (Figure 12) with different expertise reflected on how R&I can enable farming and rural communities to be more sustainable, resilient and climate smart.

Figure 12. The panellists and moderator of the third plenary session.

Gilles Saindon, Assistant Deputy Minister for Agriculture, Canada, noted that transferring technology to farmers is straightforward. However, when it is about management practices in the production environment as a whole, it implies behavioural change: there is a need to listen to the farmers on what they need to make a transition and the farmers themselves must contribute to finding solutions. Since 2018, Canada has been collaborating with European partners on the agroecosystem living labs concept while building a network of 13 living labs across Canada. In these living labs, scientists and other partners co-develop and test innovations directly with farmers, who are involved throughout the innovation process and test the practices on their own farms under real conditions. The broader goal is to accelerate the development of innovative solutions and allow for upscaling of best practices. Gilles Saindon also touched upon the importance of providing incentives to farmers, in particular to address the climate change challenge.

Mateusz Ciasnocha, farmer of the Ciasnocha Family Farms, CEO of European Carbon Farmers and member of the Mission Board of the EU Mission "A Soil Deal for Europe", conveyed two key messages: visit a farmer and a chef preparing our food, and extend 'agri' to 'agri-food' and to 'food systems thinking'. Projects have to be part of a bigger vision. A framework 'see thus act' is needed, fostering places for encounter, exchange and celebration among stakeholders. Meeting policy objectives requires scaling up solutions. To do this and apply results from R&I is a question of leadership: investing in processes is important, where one farmer is empowered and nudges a bigger group of farmers.

Stefania Avanzini, Director of One Planet Business for Biodiversity, World Business Council for Sustainable Development, noted that due to extreme weather events and climate change, our current agricultural system does not work anymore. OP2B, a cross-sectoral coalition of progressive businesses working to transform Europe's agriculture industry, are investing in the transition to regenerative agriculture, a holistic outcome-based farming approach grounded in agro-ecological principles. Today agricultural value chain actors are supporting farmers' transition towards regenerative agriculture in three ways: technological assistance, commercial assistance (price premiums) and preferential loans. To support the scale-up of regenerative agriculture, three key barriers for its practical uptake by farmers have been identified: drivers (economic incentives) in the value chain are not aligned, the risk of the transition is on farmers' shoulders and knowledge gaps at local level.

Dóra Drexler, Coordinator of the BIOEAST Thematic Working Group on Agroecology and Sustainable Yields, explained how BIOEAST is tackling issues regionally: bridging the gap between researchers working on diverse topics in different countries and organizations, and between researchers, famers, and value chain actors, including policymakers. BIOEAST offers the opportunity to its 11 EU Member States to strategically take part in EU programmes, with expertise organised around seven thematic working groups. In frame of the Agroecology and sustainable yields thematic WG networking and co-creation methods have helped to map agroecology initiatives in the BIOEAST countries, integrating all actors, and aligning the interpretation of key concepts such as living labs and lighthouse farms.

Frank O'Mara, Director of the Agriculture and Food Development Authority (TEAGASC) of Ireland, questioned to whom does R&I deliver: to policymakers so to tell farmers what to do, or to farmers directly? It should be the second. Every effort counts towards solving big problems, where R&I has delivered many solutions. There are two elements to consider when delivering for farmers: solutions must be implemented at low or no cost, or contribute to profit, and must be easily implemented. It is important to support farmers to implement the technologies that we already have available.

The Panel noted the importance of **placed-based innovation** as the means to nudge farmers in implementing new knowledge and tools in agriculture. The important **challenges of climate change and biodiversity loss require action,** and the need to use available solutions to meet the EU and other country objectives as well as UN climate and sustainability related goals was highlighted.

"There is a need to be evidence-based and not interest-based. Research policies require system thinking and not tools-based thinking" - Dóra Drexler

When reflecting on **the impediments and incentives to getting farmers adopting new and innovative solutions**, the panellists highlighted the importance of the following elements:

- Policies and regulation, incentives such as direct support to farmers and the marketplace are important elements. Articulating those in combination can help to stimulate farmers' uptake of new solutions.
- Raising awareness of the economic risk of not investing in solutions to address resilience and sustainability.
- Allowing farmers to choose from a package of practices as they know what works best for them.
- Making available a results-based framework that can measure results on the ground.
- Values are important for current farmers developing a long-term vision for the next generation in their own families.
- Listening to the farmers instead of coming as an advisor with 'I know the best solution'.
- Aligning the incentives with the best science available to tackle concrete challenges.
- The value of 'soft policies', such as education and awareness raising, that can help farmers change their mindset to invest in the solutions that go in the desired direction.

"The work of innovation is not over until it is in the hand of the farmers" - Gilles Saindon

On a **question from the audience 'is it the food system that will drive change in agriculture practice, or agriculture that will drive change in the food system?'**, views in the Panel varied. While one panellist noted that diets can be an important driver, other highlighted the role of geopolitical shocks like the war in Ukraine and its impact on fertiliser prices and use. Further views included that consumer's demand and ultimately citizens (beyond role as consumers) are important drivers, as well as the successful implementation of existing and future knowledge available through research.

To conclude, the panellists were asked to **figuratively explain to the next European Commissioner for Agriculture why R&I is fundamental for the CAP** and the EU's Multi-Annual Financial Framework. Replies pointed out the importance of rethinking the future (post 2030, towards 2050) while continuing with the current pipeline and foundation of R&I, since this is needed to continue getting into that future. The need to invest in spreading and sharing knowledge and in community building was also highlighted, so farmers in the European Union have access to the right tools. One message conveyed was the importance of backing up policy with evidence-based knowledge and applying it in practice. Another panellist conveyed that the multi-actor approach and co-creation in agriculture have

an important role when moving future agendas. Finally, one panellist noted the need to invest in processes, leadership and commitment in particular in a context of systemic approaches.

1 June: Building on achievements to shape the future

Introduction

During the second day of the conference, **participants had the opportunity to discuss and reflect on the R&I priorities for the future. This was a truly co-creating exercise**, where breakout sessions (BO) addressed in depth eight different areas with the contribution from keynote speeches, panels of experts and participants themselves.

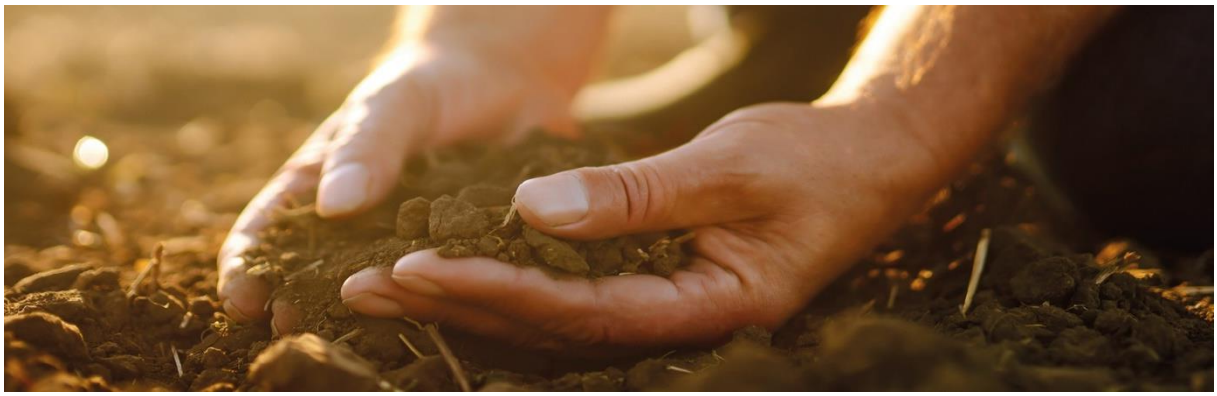
The eight BOs were organised around two main aspects:

1. R&I delivering for sustainable, climate-smart agricultural and forestry systems:

- BO1: Sustainably managed natural resources for agriculture production and the EU Mission "A Soil Deal for Europe".
- BO2: Agrobiodiversity for healthy cropping systems.
- BO3: Challenges and opportunities for healthy and sustainable livestock systems.
- BO4: Sustainable management for multifunctional forests.

2. R&I enabling a people-centred green and digital transition:

- BO5: Digital and data technologies in agriculture: R&I for sectoral transformation.
- BO6: Rural opportunities.
- BO7: Bridging the gap between R&I and practice: tools and skills for today's and future generations.
- BO8: Social Sciences and Humanities for resilient and sustainable agriculture and forestry.



BO1: Sustainably managed natural resources for agricultural production and the EU Mission "A Soil Deal for Europe"

Aim of the session

Farmland accounts for roughly 50% of the EU's surface area. Crop production relies heavily on natural resources, in particular soil and water. Despite remarkable improvements in efficiency and reduction of some negative impacts over the last decades, pressure on natural resources for crop production remains at unsustainable levels and Europe needs to further reduce the environmental impact of the agricultural sector. Agriculture itself is also increasingly affected by reduced availability of healthy soils and abundant, clean water, as a consequence of unsustainable use and climate change.

The EU Mission 'A Soil Deal for Europe' aims to lead the transition towards healthy soils by 2030. The Mission supports R&I and promotes soil-friendly practices as the basis for sustainable production in agriculture.

Through presentations, a panel discussion and a participatory co-creation exercise, the breakout session explored the present and future R&I challenges for soil and water to undertake sustainable agriculture in Europe and discussed the opportunities for international cooperation.

Keynote speech

Figure 13. Keynote speech by Martin Kováč, BO1.

Martin Kováč, State Secretary of the Ministry of Agriculture and Rural Development of the Slovak Republic (Figure 13)**,** gave a keynote speech explaining the importance of re-establishing the planet's water cycles balance, by restoring the small-scale water cycles at regional and even plot scale with local sustainable land and rainwater management practices. He recalled that every land plot and territory have its own year rainwater budget. He elaborated on the **need for developing integrated water-soil plans at local level to increase water retention capacity,** through adaptation measures (e.g. contour lines, mosaic landscapes structures) and recurrent management measures (e.g. regenerative agriculture, use of natural fertilizers, crop rotation, cover crops) coupled with adequate legislation and financial support.

The background for his presentation was the Water for Climate Healing – A New Water Paradigm White Paper , prepared by his team for the UN 2023 Water conference.

"There are two key factors that interconnect sectoral policies and strategies: water and soil. Every square meter of land has its share on the climate solutions or risks" - Martin Kováč

Overview of EU R&I activities

The Commission presented its strategic approach concerning the EU-funded research in the area, both under Horizon 2020 and Horizon Europe. Restoring Europe's ecosystems and biodiversity, and managing sustainably natural resources is one of the key strategic orientations of Horizon Europe Strategic Plan for 2021-2024.

The presentation included figures on the number of projects and funding under Horizon 2020 and Horizon Europe to advance knowledge, capacities building and innovative technologies and solutions to support the state and functioning of ecosystems, to ensure a clean and healthy environment and a sustainable management of natural resources that provides for our needs and contributes to climate neutrality and adaptation. A summary is presented in Figure 14.

Figure 14. Overview of funding and number of projects in Horizon 2020 and Horizon Europe (2021-22) on fertilisers and nutrient management, and on water management in agriculture.

R&I is leading to more balance between maintaining and enhancing yields while reducing costs and environmental impacts. In addition, developing methods to extend efficient nutrient recycling from organic waste streams contributes to reducing the dependence of European agriculture on mineral fertilisers from outside the EU. More detailed information can be found in the AgriReserch factsheet on fertilisers and the AgriReserch factsheet water management.

On fertilisers, research has advanced knowledge and innovation in sustainable nutrient management, alternative bio-based fertilisers and fertigated crops. In water management, some successful cases were presented for improved water use efficiency, water stress resilience and water and wastewater reuse.

Details were given (Figure 15) concerning the objectives of the EU Mission "A Soil Deal for Europe" (Mission Soil), the number and budget of soil related funded projects under Horizon 2020 and the

Mission, success cases and available tools supporting the adoption of sustainable management practices.

Figure 15. Overview of projects and investment in the EU Mission 'A Soil Deal for Europe' (work programme 2021-22).

R&I projects on soils cover different aspects such as decontamination, monitoring of soil health indicators or promotion of new business models for soil health (more information can be found in the factsheet-agriresearch-soils_en_0.pdf (europa.eu)).

Various relevant Horizon results packages were also highlighted: Innovative research for sustainable fertiliser production and nutrient management, Water innovation: Technological solutions for ensuring Europe's present and future water security and Soil health: Reaping the benefits of healthy soils, for food, people, nature and the climate. During the presentation, a number of additional available tools and resources were also mentioned, such as the numerous related focus groups (Fertiliser efficiency, Nutrient recycling, Digital tools for sustainable nutrient management, Circular Horticulture, Nature-Based Solutions for water management, Protecting agricultural soils from contamination, Soil salinisation, Water & agriculture: adaptive strategies at farm level), the EU co-funded partnerships PRIMA, EJP Soil and Water4All, and the Mission 'Restore our Ocean and Water'.

Panel discussion

These presentations were followed by a discussion where an expert panel (Figure 16) reacted to the keynote speech and shared their views on aspects such as the remaining R&I needs in the area. The panel was composed of four experts:

Figure 16. Panel discussion in BO1.

- **Liisa Pietola**, Senior Lead of Sustainable solutions at the Finnish Innovation Fund Sitra and Member of the Mission Board for Mission Soil.
- **Anna Osann**, Co-Funder and Executive Co-Director of AgriSat Iberia S.L and Honorary Fellow of Universidad de Castilla-La Mancha, Spain, and participant to the Horizon 2020 Project FATIMA and FaST Navigator.

- **Shamie Zingore**, Director of Research and Development at the African Plant Nutrition Institute (APNI), Benguérir, Morocco.
- **Panos Panagos**, Project Officer at the Unit 'Land Resources and Supply Chain Assessments' of the Joint Research Centre, European Commission.

Liisa Pietola argued that solutions for water infiltration, retention, and crop water supply **should be tailored to the different land uses** and their functions (e.g. cultivated soils such as arable lands or urban soils) by sustainable water management. She considered that **regenerative agriculture** should be widely used to improve soil structure and porosity for **better water and air supply**, favouring plant growth, and thus also carbon sequestration.

Anna Osann added that the **concepts of soil-water nexus in agriculture** are well known and applied in practices involving permaculture or agroecology, with several local-scale success stories available. It was now time to **mainstream these disciplines in science and policy**.

"We need convincing success stories that demonstrate quantitative evidence of the synergy potential between local agricultural production and water/soil conservation, and we need to share them in a community-based learning environment" - Anna Osann

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Panos Panagos underlined the "**4-times win" situation** of an integrated nexus approach, as introduced by Martin Kováč, which showed that, with certain soil conservation management practices and rainwater management, it is possible to reduce soil erosion, enhance carbon in soils (increasing productivity), contribute to climate change mitigation (carbon sequestration) and manage water retention (helpful especially in periods of droughts). These solutions needed to be updated and reflect the outcomes of the latest science.

Shamie Zingore noted that transdisciplinary approaches integrating research and policies for soils and water are critical for knowledge generation and impact. He explained how **sustainable water and soil management are mutually inclusive**. According to him, and improved management of both soil and water resources produces reciprocal benefits.

"The main pressure on soil and water resources in the EU comes from intensification. At the same time, 'extensification' driven by low-input agriculture is the primary driver of soil degradation in Africa, where over 60% of the productive land is degraded, affecting food security and economic development"- Shamie Zingore

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Additional remarks were made by the panellists on R&I needs. Liisa Pietola underlined the need for metrics, such as **harmonised soil indicators** to quantify problems in the water-soil nexus and monitor the progress on ecosystem services. She believes we need long-term trials, empirical research with modern farming technology, and modelling. Anna Osann insisted on the need for more **comprehensive and quantitative evidence-based success stories** on the synergy between local agricultural production and water/soil conservation, which should be shared from peer to peer in a **community-based learning process**. She also saw a need for further **development and implementation of frameworks for a systemic and holistic agricultural resources management** and their validation with stakeholders. Panos Panagos highlighted the **lack of clarity on linkages between**

soil health and climate stability, such as the role of water retention in soil health, soil erosion, soil organic matter, nutrient management and agricultural productivity. Shamie Zingore elaborated on remaining gaps concerning the **risks related to the transition to sustainable water and soil management as well as the lack of incentives,** particularly for farmers and other value chain stakeholders. **Concrete policy objectives** were also identified as a gap and as a failure to **adequately engage all concerned stakeholders** including farming communities, which was seen equally critical to balance multiple and often competing objectives and goals.

Finally, **Patrick Kelly** (Policy Officer at the Unit 'Environmental Sustainability' of the Directorate of Agriculture and Rural Development of the European Commission) expanded on the discussion with references to R&I needs such as those deriving from the Water Agenda discussed during the UN 2023 Water Conference in March 2023, in particular (i) **mapping and assessing water quantity, quality and demand**; (ii) **mapping and reducing risks from extreme weather events**; (iii) **increasing data availability and strengthening water governance**.

Co-creation of R&I needs

More than 60 participants in this session, distributed across eight tables, addressed the questions of "what" are the R&I needs around agriculture, soil and water that are currently not met, and "how" could those needs best be addressed (Figure 17).

A wide range of issues were identified on the "what" question that would merit additional R&I activities, with the following receiving the most support among participants:

Related to the scientific understanding of the issues:

- Understanding and quantifying the link between water cycle and soil;
- Long-term impacts of agricultural practices on the soil-water nexus;
- Definition and conceptualisation of "soil health";
- Links between soil health and nutrition;
- Impacts of climate change on the soil microbiome;
- Resilience of different crop species to climate change;

Regarding inputs and production methods at farm level:

- Soil regeneration methods that foster soil water functions;
- More efficient irrigation systems;
- Selection of appropriate crops and varieties according to local context and water management needs;
- Alternative (biological and physical) plant protection methods;
- Optimisation and functionalities of protein crops (legumes);
- Fertilisers of microbial origin with multiple nutrients to reduce fossil-fuel dependency;

Needs at landscape level:

- Nature-based solutions for water management;
- Recovery of water and nutrient cycles as part of a circular bioeconomy;

Supporting the design and implementation of public policies:

- Spatial planning and local/regional governance for soils;

- Harmonisation of indicators for soil health and sustainability;

With regard to the "how" question, participants identified a **need for further basic research** on most of the above-listed issues and suggested specific research topics for some of them. **Involvement of actors** was the second-most frequently identified approach, with participants highlighting aspects such as the involvement of practitioners (farmers/land managers) but also of other actors in a community/an ecosystem and of citizens in general; education and teaching in schools; inter- and multi-disciplinarity; advisory services; and the media.

Communication, networking and capacity-building were also considered relevant for addressing many of the R&I needs, with a recurring emphasis on sharing of knowledge and practices, raising of awareness, and the need to find a common language among different interested groups**. International cooperation** was considered important for analysing the impact of EU food imports on land in other regions and for learning from practices (e.g. on alternative protein), experiments and experiences (e.g. with regular flooding) in specific (third) countries or parts of the world.

Additional research needs that were suggested by participants but not discussed in detail include, for example:

- Increasing **wider ecosystem benefits** from climate-smart agriculture;
- Creating a network **of long-term trials** for soil-water-nutrient management;
- Understanding **effects of soil heating on crop adaptation strategies and the soil microbiome**;
- Developing technologies for **remote monitoring of chemicals and nutrients**;
- Improving the suitability of **monitoring data for science-based policy-making**;
- Researching the **quality and dissemination of agricultural R&I**.

Figure 17. Co-creation in BO1.

BO2: Agrobiodiversity for healthy cropping systems

Aim of the session

Agrobiodiversity entails the interaction between the environment, genetic resources, management and agricultural practices. It brings many benefits to farming systems, being an essential component of integrated crop management and low-input strategies supporting the development of healthy cropping systems. Agrobiodiversity can help achieve the objectives of the Farm to fork and the EU Biodiversity Strategies of reducing the use of chemical pesticides and fertilisers and bolster more sustainable approaches such as agroecology and organic farming.

This breakout session explored how to maximise the potential of agrobiodiversity for healthy cropping systems and discussed research needs in this area. Participants came from a variety of backgrounds, including agricultural scientists & researchers (soil, breeding, organic farming), agro-entrepreneurs, and policymakers including from the European Commission.

Keynote speech

The keynote speaker of this session was **Guy Richard**, Director of collective scientific assessment, advanced studies and foresight at INRAE (France) (Figure 18). He delivered an inspirational and forward-looking speech on the issue of pesticides. Departing from the initial benefits that the use of plant protection products brought to agriculture in the 1950s, he explained how their widespread use soon started to originate several problems and negative impacts on e.g. biodiversity and human health. Their widespread use soon started to have negative indirect influence on the evolution of plant production systems themselves, such as a great simplification of crop rotations and landscapes, and overall, a significant loss of ecosystem services, which can at the same time limit plant production. This cumulation of negative impacts leads to the conclusion that the current farming systems, still largely based on the use of plant protection products, are not sustainable. According to Guy Richard, **there are various ways in which the use of pesticides could be reduced, eventually phased out, highlighting agrobiodiversity as a key**

Figure 18. Keynote speech by Guy Richard, BO2.

practice in this sense, for its demonstrated capacity to regulate plant pests, and to bring along other ecosystem services. He explained that despite the recognised benefits of crop diversification, there is a lock-in of the agricultural system which prevents moving towards a more systematic implementation, such as uncertainty related to profitability, or the lack of market outlets. These aspects confirmed that **more research is needed to improve knowledge and understanding of the multiple factors involved, and the need to look for changes in a systemic way and at various dimensions and scales, considering the entire agri-food system.**

"We have doctors to deliver the medicines to heal people, we have veterinarians to provide medicines to treat animals, should not we consider pesticide prescribers?" - Guy Richard

Overview of EU R&I activities

The Commission presented an overview of EU R&I activities related to agrobiodiversity for healthy cropping systems. The need to further explore the interconnection between plant health, resource management and integrated ecological approaches from farm to landscape was identified as a priority in the long-term strategic approach to EU R&I (europa.eu) aiming for sustainable primary production. The EU has supported three main areas of R&I with substantial funding under Horizon 2020. These priorities are being further boosted under Horizon Europe. R&I actions in these thematic areas contribute to the expected impacts set for Cluster 6 in the Horizon Europe Strategic Plan 2021-2024, notably in relation to biodiversity and to farm to fork, in line with the Green Deal strategies and targets for 2030. The ongoing efforts and investments (Figure 19) underscore the commitment to further advancing R&I in agrobiodiversity and to maximise its potential for healthy cropping systems. An overview of the actions can be found in the related factsheets: agroecology and organic farming, plant health and genetic resources and breeding.

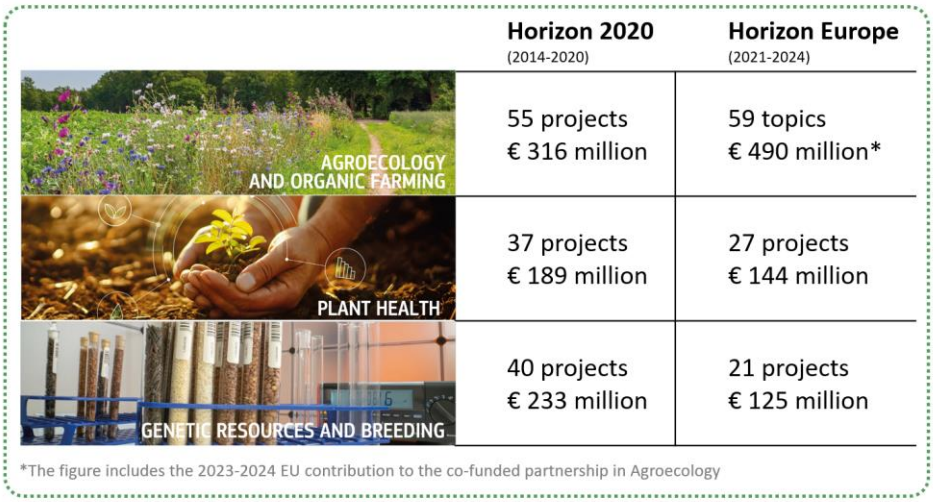

Figure 19. Overview of R&I funding under Horizon 2020 and Horizon Europe dedicated to the thematic areas of Agroecology and organic farming, plant health and genetic resources and breeding.

An important characteristic of several of the R&I actions funded under these priorities is that they follow a multi-stakeholder engagement approach, also known as the *multi-actor approach.* This means that genuine involvement of farmers and relevant stakeholders has been ensured in the research project activities. This has contributed to a significant progress made in the last decade, providing

farmers with innovative solutions and new knowledge ready to be used. Some of the most relevant project results can be found in two CORDIS results packs (Agroecology: transitioning towards sustainable, climate and ecosystem-friendly farming and food systems and Plant health: keeping plants healthy while protecting the environment).

Besides the Horizon Europe Work Programmes, various instruments such as the EIP-AGRI funded by the CAP, the EU Mission "A Soil Deal for Europe", and the future Agroecology partnership also play a crucial role in maximising the potential of agrobiodiversity (Figure 20). The latter is a large-scale initiative involving Member States and Horizon Europe Associated Countries to design and implement a common agenda of R&I activities for several years.

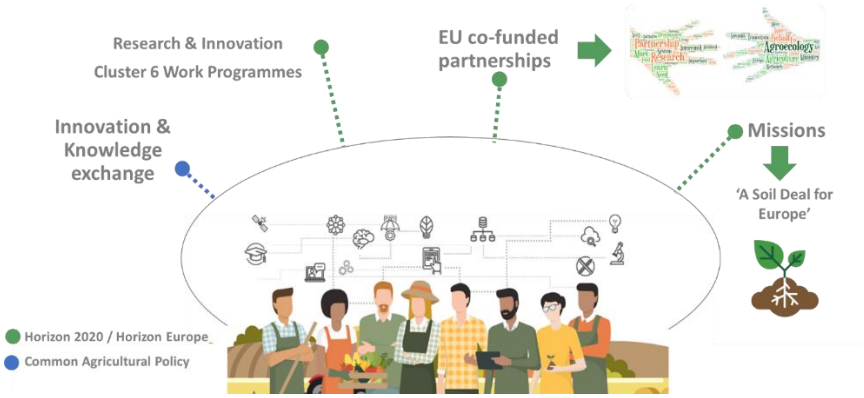

Figure 20. Various instruments and multiple stakeholders are key to maximise the potential of agrobiodiversity for healthy cropping systems.

Panel discussion

Building on the ideas of Guy Richard, a panel of experts (Figure 21) engaged in a lively discussion about the progress made as a result of EU-funded research in the field, as well as the contribution of new instruments in Horizon Europe and EU policies to tackle the challenges associated with promoting agrobiodiversity as a tool for achieving healthy cropping systems.

The panel was composed of:

- **Benjamin Sanchez Gimeno**, Senior Researcher, Spanish National Institute for Agricultural and Food Research and Technology
- **Marta Vasconcelos**, Researcher of the Biotechnology and Chemistry Centre, Universidade Catolica Portuguesa, Porto
- **Claudia Fusco**, Head of the Unit Green Knowledge & Research Hub and LIFE Programme of the Directorate General for Environment of the European Commission

Figure 21. Panel discussion in BO2

The panellists explored to maximise the potential of agrobiodiversity, and on the most pressing research needs in this area.

Marta Vasconcelos confirmed that the EU has already devoted significant financial resources to support research in this area. Mentioning the examples of several past and ongoing EU-funded research projects, as well as activities under EIP-AGRI, she concluded that **substantial evidence, knowledge, and a significant amount of innovations already exist that demonstrate that agrobiodiversity works**. However, progress is varied, and these knowledge and tools have yet to reach society broadly.

Benjamin Sánchez elaborated on the key role that the future Horizon Europe Partnership on Agroecology will have in providing solutions adapted to specific local conditions in Europe and fostering science-policy dialogue.

"The future Horizon Europe Partnership on Agroecology will enable to identify, test and adapt solutions to specific local conditions. By relying on Living Labs and Research infrastructures, co-creation, co-development and co-sharing of knowledge will be ensured" - Benjamin Sanchez Gimeno

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Claudia Fusco emphasised the relevance of several EU policies and initiatives, such as the EU's biodiversity strategy for 2030, the Commission's proposal for a Nature Restoration Law and the upcoming proposal for an EU Soil Law, to protect nature and reverse ecosystem degradation. She referred to **the LIFE programme, under which several projects have already developed innovative solutions for sustainable agriculture.**

The panellists **recognised several barriers to upscaling agrobiodiversity in the EU**, starting with the need to better understand, demonstrate and quantify its benefits and trade-offs for all actors in the agri-food system. The panellists underlined the **urgency of a systemic change in how we produce food towards one that relies on knowledge, skills and the potential of more sustainable approaches, such as agroecology**. Panellists also elaborated on the suitable approaches to adopt. They found that while a 'top-down' approach is necessary to provide a favourable framework, the bottom-up approach is the most appropriate one to understand local challenges and to find solutions through co-designing approaches that involve farmers. The geographical scale is also relevant, hence the need to consider both the farm and the landscape levels. New business models and the need to build governance systems that support and incentivize the transition, sharing benefits, trade-offs and risks among all actors with a stake, were highlighted.

"The move towards agroecology is possible only if the sector itself can benefit from it. There is evidence of long-term benefits of agroecology for farmers, but more research and communication efforts are needed to convince the sector" - Claudia Fusco

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Concerning research needs, the panellists underlined **knowledge gaps regarding the effects of pesticides on biodiversity and ecosystems, support for the restoration of agricultural ecosystems** ('farming with nature'). Furthermore, there is a need for evidence on the environmental, social and economic benefits of sustainable approaches such as agroecology, and strategies to increase the resilience of agrobiodiversity in the face of climate change. Panellists also elaborated on the need to

identify potential trade-offs or undesired side effects in the long term, for which proper monitoring systems need to be in place. Last but not least, important research needs concern **the role of consumers and other actors of the agri-food chain in driving the necessary changes**, and how to reconcile the priorities of different actors towards unified strategies and tools that promote agrobiodiversity. The need to establish an instrument within Horizon Europe to gather existing knowledge and innovations, and that allows to identify the research needs was highlighted.

There were to questions from the floor about how R&I can support the implementation of the relevant measures under the CAP (e.g. eco-schemes, agri-environmental measures, etc.) that are already supporting many of the objectives and ambitions discussed, and the need to support farmers but also other actors along the agri-food chain. The panellists emphasised the **importance to have an array of measures available for farmers to decide which one(s) better work for their context or problem.** This is very much in line with the subsidiarity principle and with the importance to implement the solutions at the local level. The panellists also emphasised the importance of monitoring biodiversity and having the right methods to do so. Finally, **the cost of non-action also needs to be estimated.**

"We (society) must understand that if we maximize the potential for agrobiodiversity and we generate healthy cropping systems, we will ultimately benefit farmers and all other value chain actors" - Marta Vasconcelos

Co-creation of R&I needs

The last part of the break-out session consisted of a **co-creation discussion to gather the inputs of the 60 participants to harvest feedback on R&I needs**. The discussion was conducted in eight tables, each with one facilitator (Figure 22). Two questions were discussed; firstly, participants were invited **to identify the research needs in the area**. Afterwards, they voted in order to **prioritise the main ones**. Finally, they proposed **how to deliver through R&I on those needs**.

Figure 22. Co-creation in BO2 with a flipchart with participants' ideas.

Main results

The co-creation exercise delivered the following **main research needs, and ways on how to address them,** regrouped in **three main themes**:

Theme 1: Assessing the impact, benefits and trade-offs of agrobiodiversity

The session's participants emphasised the need for R&I to continue to help improve monitoring of the impacts, benefits and trade-offs of agrobiodiversity across the value chain, including by developing appropriate **indicators**. Participants insisted in particular on the effects of agrobiodiversity on increased yields, on the provision of ecosystem services such as pollination, on a reduced reliance on synthetic inputs, marketability, and overall, on improved sustainability across its three pillars.

The impact of alternative approaches to the use of pesticides on farming sustainability was also pointed out as a R&I need, as well as the need of exploring the potential of remote sensing tools to monitor the environmental impact of these alternative approaches for the purpose of supporting policy development/implementation.

Theme 2: Value chain & farm competitiveness during transition to a more diverse agriculture

The participants highlighted that in order to a**ddress the challenges of transitioning to more agro-biodiverse farming systems,** a holistic approach is required that considers not only ecological but also **economic and social dimensions**. Participants mentioned in particular the need to:

- **improve and adapt the value chain** to accommodate **increased agrobiodiversity**, with **the involvement of various actors**.
- pay particular attention to consumer behaviour and to incentives for farmers to encourage the transition.
- explore avenues that **link agrobiodiversity with farm profitability,** beyond subsidies. This includes **promoting new or alternative markets for farm product diversification**.
- **undertake economic analysis on the impact** of **transitioning** to more agro-biodiverse systems.
- explore how newly available remote sensing tools can **help a more optimal use** of agricultural inputs, such as fertilizers and pesticides.

As means to address these specific needs, participants pointed out undertaking analysis of **farmers' expectations**, developing methods of assessing agricultural productivity and ecological services, and undertaking market research into **new business opportunities** (e.g. carbon farming).

Theme 3: Breeding for Agrobiodiversity

The participants emphasised the importance of **advancing breeding methods for agrobiodiversity** while considering the needs of healthy and resilient cropping systems was highlighted. In particular, participants underlined the need to:

- further study the **role of plant ecology in crop breeding** with a view to foster a more diverse agricultural landscape.
- i**mprove cultivars specifically for practices that promote agrobiodiversity**, such as intercropping.
- further explore the **potential of boosting and adapting niche crops**, not only for agrobiodiversity, but also considering dietary shifts and human health.
- Undertake basic research **assessing crop biotic and abiotic stress** (especially drought tolerance) to **develop resilient varieties**.

As means to address these **research needs, participants highlighted:**

- **The importance of undertaking long term and holistic applied research**
- Participatory and bottom-up research approaches, in particular **Multi Actor & bottom-up approaches and Living Labs** including policy makers.
- Mechanisms to bring the knowledge and innovation close to farmers and other end users, and training opportunities for all value chain actors (in particular farmers).
- Public-private partnerships, in particular for breeding, were proposed to foster the development of plant varieties.
- The development and use of digital tools and/or platforms that are easily accessible and cost-effective for end users.
- Design effective communication strategies to **raise awareness of the benefits of agrobiodiversity for different actors in the value chain.**
- Develop certification schemes for agroecological / regenerative farming products.

BO3: Challenges and opportunities for healthy and sustainable livestock systems

Aim of the session

While livestock production is a major contributor to agricultural and food outputs and contributes to rural livelihood and to shape landscapes, sustainability and resilience of livestock systems are questioned on many aspects: impact on natural resources and on environment/climate (greenhouse gases, pollution, biodiversity), on health (diet, antimicrobial resistance), on animal welfare (ethical issues). Socio-economic conditions are hardly attractive to ensure generation renewal (working conditions, low economic return).

This breakout session explored the R&I needs and the opportunities to address these challenges, focusing on animal health and welfare, including one health, on environment and climate change, on socio-economic aspects, on circularity and system approach, in order to move towards sustainable European livestock systems.

Keynote speech

Frédéric Leroy, Professor at the Bioengineering Sciences Department of the Vrije Universiteit Brussel (Figure 23), opened the session with a speech on "**Challenges and opportunities for healthy and sustainable livestock systems".**

Figure 23. Keynote speech by Frédéric Leroy.

Frédéric Leroy set the scene by referring to the definition of sustainable diets according to FAO: "sustainable diets have low environmental impacts [...], are protective and respectful of biodiversity/ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy while optimising natural and human resources[1]". Quoting the Dublin Declaration[2]: "Today's food systems

[1] FAO, 2010, Sustainable Diets and Biodiversity

[2] https://www.dublin-declaration.org

face an unprecedented double challenge. There is a call to increase the availability of livestock-derived foods [...]. At the same time, some methods and scale of animal production systems present challenges with regards to biodiversity, climate change and nutrient flows, as well as animal health and welfare within a broad One Health approach".

In order to mitigate challenges, Frédéric Leroy noted that **there is a role not only for high-tech interventions (big data, precision agriculture, genetics, etc.), but also for options like silvopastoralism, diversification strategies, de-concentration, or circularity. Let's target both the obvious domains (food waste, carbon sequestration, etc.) and the "less known"**. There are many uncertainties and knowledge gaps, notably on methodologies and on the socio-economic aspects of transformation. For livestock farming to move towards sustainability, he noted it should be turned into a rewarding, viable career choice. For a systems approach, a 'tunnel vision' should be avoided, and metrics matter a lot. He acknowledged the need to demonstrate tangible benefits of specific interventions (benchmarking), and to establish clear research/policy frameworks, with workable science-informed regulatory mechanisms, transparent and robust accounting systems, certification, and fair compensation (e.g. carbon markets). There is a need to factor in trade-offs and reference points, to **take into account the different scales (animal, farm, region, global)**, the complexities (e.g. land sharing/sparing debate), and look for net benefits. Most large systems have multiple functions and estimating "efficiency" is tricky.

Frédéric Leroy concluded that caution is needed, acting to increase the options, which will often require interdisciplinary research.

"Assessing the sustainability of the livestock sector requires to factor in trade-offs and reference points, to take into account the different scales, the complexities and look for net benefits" - Frédéric Leroy

Overview EU R&I activities

The Commission provided an overview of R&I actions and tools under Horizon 2020 and Horizon Europe related to livestock systems.

Regarding livestock farming systems, Societal Challenge 2[3] and Cluster 6[4] support the restoration of ecosystems and biodiversity and the sustainable management of natural resources, which are key strategic orientations of Horizon 2020 and Horizon Europe.

Overall, research on livestock funded by the EU framework programmes has evolved over time, reflecting changes in societal concerns, environmental awareness, and the need for sustainable and resilient agricultural practices. For the first four years (2021-2024) of Horizon Europe, the Commission expects to finance 25 livestock projects with a total EU contribution of about 180 million, including the co-funded Partnership on Animal Health and Welfare.

Livestock R&I has utilised a range of instruments within the framework programme to address diverse objectives (Figure 24). The variety of these instruments, from collaborative projects to networking, co-

[3] Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy

[4] Food, Bioeconomy, Natural Resources, Agriculture & Environment

fund actions, and cooperation at bilateral, multilateral, and international levels, reflects different objectives and priorities, emerging challenges, and the integration of technological advancements to progress towards sustainable and resilient livestock systems, while ensuring their productivity.

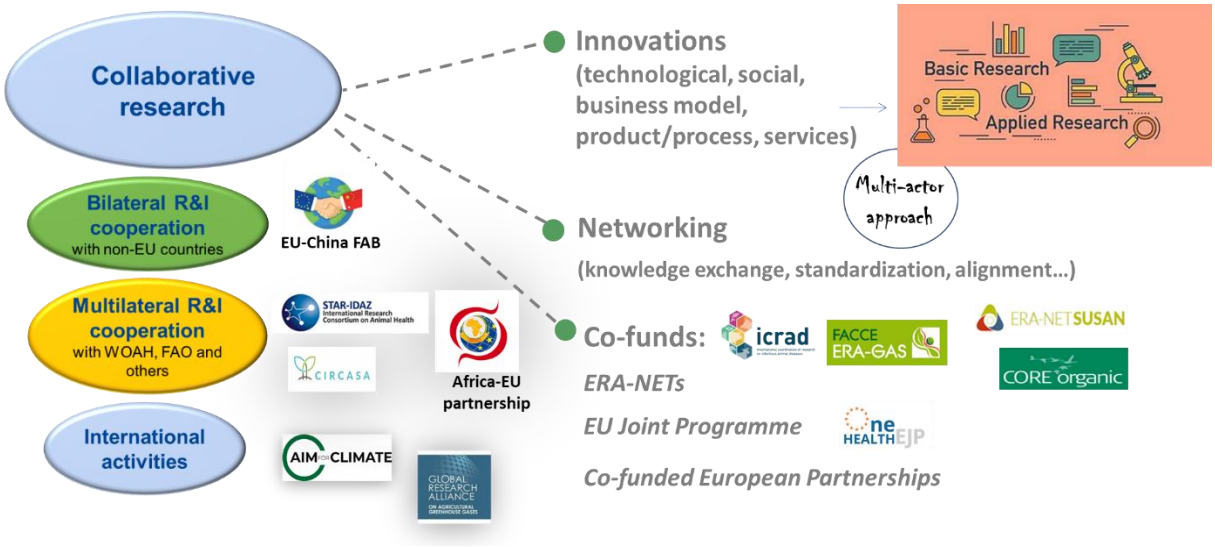


Figure 24. Available actions and instruments for research on livestock.

Panel discussions

The panel was composed of four experts (figure 25):

- **Elke Saggau**, Head of the Division "European Research Affairs" at the Federal Office for Agriculture and Food, Germany.
- **Carlos das Neves**, Chief Scientist of the European Food Safety Authority, Italy.
- **Wim H.M. van der Poel**, Professor of Emerging and Zoonotic Viruses at Wageningen University and Research, The Netherlands.
- **Sophie Hélaine**, Head of Unit "Policy performance" of the Directorate General for Agriculture and Rural Development, European Commission.

The panellists were asked what the important challenges or opportunities for livestock farming systems are and how R&I can address them.

The panellists noted that **adaptation and mitigation** are two key strategies in addressing climate change impacts in the context of livestock production. While the full consequences of extreme weather events are not entirely predictable, research on husbandry practices, breeding and genetics, and animal health and welfare can enhance livestock resilience. Innovative technologies such as omics, vaccines, and therapeutics in the field of animal health, help in addressing various challenges like epizootic animal diseases and zoonosis, securing food production.

Discussions highlighted that i**nterdisciplinary collaboration** among researchers, policymakers and stakeholders throughout the food chain is required. Processors, retailers, and consumers have an important role in driving changes in the food systems. At the same time, an optimal policy mix that balances the needs of livestock farmers, consumers and the broader society, considering **regulatory approaches**, **incentives** and **private sector** involvement, is beneficial.

"Livestock systems R&I require interdisciplinary collaboration among all stakeholders along the food chain: researchers and innovators, policymakers, private sector and let's not forget also customers" - Carlos das Neves

The panellists stressed that **scientific evidence** is particularly important for decision makers and EU agencies. This is crucial for the livestock sector, which is subject to various risks, including disease outbreaks, climate variability, natural disasters, and market volatility. Quantified scientific-based evidence of multiple positive and negative externalities and impacts and trade-offs of maintaining or changing livestock farming systems is needed.

One of the main requirements highlighted by the Panel was the **coordination** at national and EU level regarding monitoring information systems, preparedness, investments, data, to name a few examples. However, the lack of sufficient data and human resources poses challenges, even for decision-makers. **Educating** people, including the new generation of scientists and risk assessors, is necessary. Furthermore, human resources are needed to fill the gap between farmers and scientists, and the multi-actor approach (MAA), even if successful, should be strengthened. Advisory services, benchmarking and peer-to-peer learning are central in helping livestock farms to be more innovative, productive, and environmentally sustainable.

The Panel noted that closer **coordination of R&I (R&I) activities** at EU and global levels is also a key issue in the transformation of the livestock farming. The Member States, associated countries (e.g., Collaborative Working Groups of the Standing Committee on Agricultural Research) as well as international consortia (e.g., International Research Consortium on Animal Health "STAR-IDAZ IRC") are reflecting on these challenges and gaps and provide advice and knowledge to set and align R&I for a future healthy and sustainable livestock sector.

Figure 25. Panellists of BO3.

The panel highlighted that t**ransition costs** towards sustainable livestock systems must be assessed, comparing short term costs versus long term (socio-economic and environmental) benefits at **different scales** (farm, region, global) and systems. Different systems require tailored solutions. In the case of circularity, for example, "what is the most appropriate scale to deal with the Nitrogen cycle, while increased strategic autonomy is required?". Appropriate **indicators** at **macro level** (impact indicators that can be linked to policies, e.g., CAP) and at **micro level** (at farm level to multiply result-based schemes) must be identified and collected at a reasonable cost and frequency for easy implementation by farmers.

Addressing social aspects is also critical according to the Panel, particularly the **generation renewal** of the livestock farmers. Lack of attractiveness because of poor image of livestock production, labour constraints, high capital needed, low setting-up outside the family, lack of farm managers and skilled labour need to be addressed. **Collective approaches** in diversification strategies, short/local supply chains, and balancing production and environmental objectives should be pursued. Opportunities for farmers such as data utilization and carbon markets can contribute to livestock farming attractiveness.

To increase the likelihood of **project outputs** being implemented and to prevent them from being shelved, the Panel noted the importance to focus on effective implementation and follow-up actions **after the end of a project.** This includes for example the swift sharing of project outputs and outcomes, continuous engagement of relevant stakeholders, and strategic efforts to replicate the successful outcomes in various contexts to favour product/process/system implementation as well as attention to legislative requirements.

Co-creation of R&I needs

This break-out session focused on specific R&I aspects aiming to support the transition to sustainable livestock systems and on identification of relevant R&I needs (Figure 26).

Four themes were chosen:

- Animal Health & Welfare
- Resource use and Environmental Impact
- Socio-economics
- System approach & circularity

There were around 50 participants in this break-out session. Eight round tables were organised, with two separate tables per theme.

Each table discussed two questions, around ‘what’ and ‘how’.

- ‘What’ are the R&I needs to address the challenges / seize the opportunities of the area?
- How should those needs be delivered through R&I? (for each need, starting from higher priorities; possible cross cutting aspects)

The main results per theme of this co-creation exercise are presented below.

Theme “Animal Health and Welfare”

- Need for **innovative intervention technologies** for animal health and welfare (AHW) such as on-site diagnostic tests, and vaccines. To this aim, Knowledge on host-environment-pathogen interactions must be enhanced alongside a better control of antibiotic use, new therapeutics, and novel feed to reduce use of medication.
- Adopting a **system approach**, **benchmarking** AHW become crucial for sustainable animal production and enhancing the competitiveness of agriculture and food industry on the international market: research on economics, circularity, modelling, and on quantification of impact of AHW on economics, environment.
- The **One Health** concept must be operationalised as part of sustainability assessment.
- Improving **data** collection, curation and smart use are vital; research on standardization, modelling, development of platforms.

Some outputs on '**how'** were applicable virtually to all identified priority needs. These include: bridging fundamental and applied research, translating scientific results into practical tools that can be easily used and understood by the end-user; differentiating 'universally' adaptable scientific findings and 'regionally' or context specific results; option to split projects in 2 parts (research then implementation); maintain networks after projects; need not to develop too broad topics (focused (bottom-up) projects remain important). The '**how'** specific for the above identified needs were: addressing all technology readiness levels; involving all sectors (industry, especially SMEs; farmers) and interdisciplinary and comparative projects (for '**intervention technologies'**); funding systems to connect partnerships and initiatives (for '**One Health'**); a better EU legislation to regulate and enforce data sharing (for '**data**').

Theme "Resource use and Environmental Impact"

- **Optimization of feeding** systems including feed additives (e.g., algae) to reduce emissions and maintain or enhance efficiency simultaneously.
- **Building scenarios** for future-proof livestock production by considering R&I needs for 2050.
- **Outdoor measurements** of environmental and climate impacts for optimization of livestock systems.
- **Breeding**, physiology, genetics and economic aspects with special attention to minor and local breeds as well as affordable phenotyping tools for a long-term strategy.
- Address **local** conditions throughout the **entire value chain**, from feed to diet without disregarding the global market.
- **Exchange of knowledge and data** between livestock farming and the private sector, along with **integrating/interacting** within and between different livestock systems and specialized research.
- Options for **individualised animal management**, akin to personalised medicine in humans, to optimize resource utilization. The practical applicability and costs of digital tools and PLF in different systems must be assessed.
- Maximise sustainability, efficiency and adaptability may involve improving **existing tool or developing a new one** rather than seeking multiple new tools.

Outputs on the '**how'** were quite common to all identified priority needs. These include basic and applied research, socio-economic analyses, cooperative involvement, regional approaches, incorporation of Social Sciences and Humanities, and a mix of specialised and holistic approach.

Theme "Socio-economics"

- **New business models** to make farming more economically viable and environmental/climate friendly.
- Innovative tools providing **real-time market data** for informed decision-making and efficient investment planning by farmers, considering externalities and appropriate indicators for, data harmonization, collection, and modelling.
- Addressing **farmers' mental health** and behaviour, identifying prevalence and causes at territorial level. Generation renewal, drivers for farmer's retirement, supporting female and new entrants' participation.
- **Carbon farming** as a viable income source. Tools to quantify, measure and reward carbon storage in different farming practices.

- Management of **local breeds**, considering their historical, economic, and cultural values, and supporting social farming for vulnerable communities.
- Strategies to reduce **farm abandonment** and transform livestock farms into more sustainable productive activity.

Some outputs on '**how'** were common to all identified priority needs: MAA; communication and networking; interdisciplinarity; international collaboration. The '**how'** specific for the above identified needs were: demo (for **Business models**); standardisation, especially on externalities (for **Real-time data**); Operational Groups to scale-up solutions (for **Carbon farming**); inclusion of cultural heritage/tourism sector in the consortium, TRL 6-7, education, and policy analysis (for **Local breeds**); regional aspects (for **Farm abandonment**).

Theme "System approach & circularity"

- **Impact of reduced** herd size and livestock production on demand and food security, circularity approach, nutrient cycle, and land use at different scales.
- Identify and assess **sustainable systems** answering local and global needs / challenges.
- **Long term sustainability** of livestock systems with economic optimization from extensive to intensive use of inputs.
- **Data on externalities** (cost/benefit) of livestock systems within the food system. Data on real food consumption.

Some outputs on '**how'** were common to all identified priority needs: monitoring data; definition of 'optimal size' and its impact on all different aspects (system approach) to guarantee long-term sustainability; scenario analysis/modelling and potential related implementation; regional dimension; definition of resilience, externalities. The '**how'** specific for the above identified needs were: technical support (e.g., genetics, mixed farming), observatory to share ecological, environmental, biodiversity, carbon performances, living labs to test farmers' response (for **Sustainability**); pilot farms, policy integration (for **Data on externalities**).

Figure 26. Co-creation in BO3.

BO4: Sustainable management for multifunctional forests

Aim of the session

Forests have a multifunctional role, offering a wide range of environmental, economic and social services and goods. The sustainable management of European forests and the use of wood as sustainable raw material have a crucial role to play in the achievement of the EU's policies, including climate. It is also key for the transition to a circular and sustainable bioeconomy as well as the conservation of biodiversity and the provision of ecosystem services such as recreation, clean air and erosion control among many others.

This session explored present and future challenges for forests in Europe and reflected on opportunities arising from R&I.

Keynote speech

Robert Mavsar, interim director of the European Forest Institute (Figure 27), opened the session with a keynote on: "A better stakeholder interaction is needed in order to make use of the knowledge".

Figure 27. Robert Mavsar, keynote speaker BO4

The keynote started presenting the multiple global challenges that the societies in Europe face, such as climate change, environmental degradation and the loss of forest biodiversity, the population growth and related urbanization, and the effects all those have on forest ecosystems and on the society and the challenge to provide food security to all. He mentioned **that to tackle these challenges, there is a need for a change, including discussions on the value of nature, a re-thinking of the economic models that we currently use, and a development of innovative governance models.**

Forests are playing a crucial role in the well-being of society since they provide crucial ecosystem services. He also highlighting that some objectives might not be coherent, e.g. choosing between protection or use of forest resources. At the same time, **science as a key role in tackling multiple global economic, ecological, and social challenges**. According to him, scientific knowledge is necessary for an objective decision making. New knowledge on resilience and governance is available, but a better stakeholder interaction is needed in order to make use of that knowledge.

"Forest plays a crucial role in the well-being of society because they provide many crucial ecosystem services" - Robert Mavsar

Overview of EU R&I activities

The European Commission provided an overview of EU forest R&I, which is guided by a long-term strategic approach where the outlined strategic priorities focus on creating value from land through sustainable primary production and on enhancing rural innovation. The priorities of the strategy are then further detailed to develop specific lines of action that feed in our R&I programming. For the first four years (2021-2024), the Commission expects to finance 22 forest projects with a budget volume of € 140 million. Figure 28 summarises elements of EU R&I on forestry.

Figure 28. Forestry research under Horizon Europe (2021-24).

Compared to Horizon 2020, this is a budget increase of around 50% on a yearly basis. In addition, the multi-actor approach has been reinforced, to ensure that all relevant key actors, including forest managers and owners, are involved in the projects from the very beginning. Synergies are created through the CAP, the EU partnerships and missions to address some of the most pressing challenges.

Panel discussions

The panel was composed of four experts (Figure 29):

- **Florence Pendrill**, Senior Research Officer, Swedish Research Council for Sustainable Development.
- **Davide Pettenella**, Professor, Department of Land, Environment, Agriculture and Forestry, Padua University, Italy.
- **Nike Krajnc**, Director of the Slovenian Forestry Institute.
- **Gerhard Weiß**, Senior Scientist at the Institute of Forest, Environmental and Natural resource Policy, University of Natural Resources and Life Sciences of Vienna, Austria.

The panellists were asked from their experience, apart from climate change and biodiversity loss, what are the future megatrends and their impacts at EU-level, national and regional level, and how can R&I contribute in being better prepared.

Nike Krajnc explained that more pressure on forests (e.g. extreme weather events) can be seen. This includes also an increased demand from society for various forest services. More extreme and

unpredictable events, that caused major damages to forests, have been seen during the past years. According to her, **R&I should contribute to a better understanding and balance between the capabilities of forests under a changing climate and the needs of society**.

Davide Pettenella said that more frequent extreme climate events will also have a social and economic impact. These changes are unpredictable, which leads to an instability of forest product market. To tackle these problems **international cooperation effort and regional cooperation is needed**. He also stressed that there is an increase demand of forest-based socio-cultural ecosystem services.

For **Florence Pendrill**, the evolving demands of the bioeconomy, as well as the need to change towards a smarter and more equitable society is an additional challenge. **Modern technologies can bring multiple potentials for improvement of increased sustainability and added value of products**. We might be close to a "polycrisis" – where climate change, biodiversity loss and other global risks interact with each other with compounding effects, such that their overall impact exceeds the sum of their individual parts. According to her, R&I is crucial in all these cases, and in different ways, but perhaps particularly so for illuminating these multiple and interacting challenges, and how to address them and their consequences systemically.

According to **Gerhard Weiß**, climate change and biodiversity crises make a societal transformation towards more sustainability necessary. Although these needs have not changed since decades, they become even more pressing. On the other hand, globalization and the "acceleration of societal life" increases an unsustainable way of life. The increasing economic efficiency implies a loss of buffer capacities, which makes our society increasingly vulnerable towards any disturbances, including weather extremes. According to him, the increasing global interdependencies make it easier for powerful actors to increase influence and profits at the expense of democracy and social equity. Therefore, **R&I must be oriented towards sustainability transformation, democracy, and integrated policy goals.**

Figure 29. Panellists and audience of BO4.

From a context where these challenges are addressed by separate domains of action like biodiversity, climate change, or industry, putting the society at risk of opposing holistic solutions, the panellists were asked: how can society better address synergies and trade-offs in R&I for multifunctional forests?

According to Nike Krajnc, society's demands for forest protection on the one hand, and the needs of the bioeconomy on the other hand, can be challenging for R&I. Therefore, she considers the need to **promote further technological innovations that cause as little damage as possible to forest ecosystems, and increase at the same time the efficiency of forest operations**. She also noted that more research in the area of social innovations is needed to better address synergies and trade-offs.

Davide Pettenella considers that the work done by the JRC on global footprint of (EU) consumers' behaviour is important. Based on the work, a sustainable and balanced use of natural capital, the trade-offs of the sectorial policies (e.g. biodiversity protection, food production, biomass production, and water consumption) can be defined. **The challenge is not only one of rationalization in the use of natural resources, introducing adapted technology and land use policies, but also changing of consumers' lifestyle**. According to him, de-materialization of forest economy and introducing elements of the shared economy might be the way forward.

According to Florence Pendrill, there are many ways where research can help contribute to holistic solutions (e.g. by quantifying impacts of different solutions; or developing alternative business models; or finding processes that can be useful to reconcile). It is important to acknowledge that trade-offs with often different values exists. According to her, that means **that holistic and systemic solutions cannot be determined by research alone, but also need to include value judgements, ultimately a policy question**. There is a need to think strategically about what is needed to strengthen the knowledge base. Also, there is a need to make knowledge useable to stakeholders.

"Holistic and systemic solutions cannot be determined by research alone, but also need to include value judgements, ultimately a policy question" - Florence Pendrill

According to Gerhard Weiß the inter- and transdisciplinary R&I is still lacking in many public and private universities, research institutes and national funding programmes on the agenda. **The EU R&I programme with the multi-actor approach is at the forefront**. Those inter- and transdisciplinary features, including the strengthened role of SSH, social innovation or gender mainstreaming should be kept or fostered in the future. However, on the other side an increasing bureaucracy and detailed project management requirements seem to become counterproductive and put innovativeness and creativity at risk. He argued for an increased flexibility and the possibility for additional activities during or after the project lifetime.

The traditional, top-down model of knowledge transfer from science to practice is clearly outdated. Already today, co-creation and sharing of knowledge among different key actors with complementary expertise is promoted through the multi-actor approach. The panellists were asked **how to further advance the engagement of forest owners and managers and accelerate the uptake of R&I results on the ground.**

Nike Krajnc considers that **pilot projects are a good tool** to bring existing knowledge to the ground and also to gather the needs of forest owners and other stakeholders. Here, focus groups where researchers from different sciences, land and forest owners have to cooperate in the practical implementation of solutions, could be the way forward. In addition. She considered, that in addition to practical implementation projects, also basic research needs to be funded to develop new solutions that can support the implementation of projects.

David Pettenella noted that the current land ownership structure is not adequate for the changing demand of society for products and services and proposed to introduce new land tenure models. This would require the **analysis and test of new forestland management models and contractual arrangements among landowners, local communities, policy makers, and managers**. More work needs to be done in finding the right balance between activities to be carried out at small scale with

local stakeholders and comparing positive and negative lessons learned from experiences in different contexts.

Florence Pendrill highlighted that the complex societal challenges need research, innovation and valorisation at multiple levels and with range of actors and stakeholders (incl. forest owners, industry, investors, and different levels of government). A good example is the EU-funded project EUFORE, which involves a wide range of actors for developing a Strategic R&I Agenda. According to her, the **global interconnectedness of the societal challenges as well as the solutions, can benefit of a coordinated R&I at the EU level**. Florence Pendrill also mentioned that in the work with stakeholder it is crucial to maintain academic freedom and integrity.

Gerhard Weiß suggested that more resources should be given to both research and practice partners to participate in co-creation. Also, more flexibility would be supportive for user-oriented co-creation, and for providing creative space for innovative research. According to him, although project planning, monitoring and evaluation are needed, **projects need sufficient flexibility to effectively do stakeholder involvement, co-creation and innovative activities**. Better involvement of forest owners and managers could be reached through collaboration with various organisations from forestry and the forest sector, e.g. forest holdings, cluster organisations, LEADER/CLLD local action groups, Operational Groups, forest cooperatives, forest extension services, interest groups or other local, regional or national structures. Such organisations need very simple, unbureaucratic instruments and forms of reimbursement.

Co-creation of R&I needs

The last part of the breakout session consisted of a co-creative discussion with the approximately 40 participants that joined. The co-creation exercise, organised around three themes, aimed at identifying future R&I needs in the forestry and bioeconomy sectors.

The summary of the main findings from this exercise is presented below.

Theme 1: Bioeconomy

- Ensuring an inclusiveness and interconnection in innovative value chain: foster the interface between foresters/forest owners/forest managers and innovative forest product users (e.g.: pulp industry for textile, timber for construction, biomaterials for packaging).
- Fostering societal perception of and discourses on the bioeconomy and forestry: SSH should study the behaviour, attitudes, perceptions, and discourses of citizens of forestry, to better understand how/why forest products are used (or not) in the bioeconomy and how they can enter the market.
- Develop new nature-based solutions to accelerate the growth of healthy forests and as a response to the lack of forest regeneration. The changing environments mean that we will face needs of change in the forest management.
- The various needs mean various trade-offs. There are a number of questions we need solve in this respect, for example how to balance a technological approach (low quality wood, value chain approach) in bioeconomy with a social one (non-wood forest products; horizontal/territorial approach).

Theme 2: Biodiversity and climate

- Understanding resilience of forests in the face of increasing extreme weather events throughout Europe. It is necessary to invest in knowledge building on sustainable management practices that

support resilient forests, but also to improve risk analyses and modelling of disturbance events and climate.

- Fostering communication as a research need and 'how' to do it. It should be incorporated in all branches of research regarding forests, climate and biodiversity.
- Improving measurement of forest related properties and variables. Many measurement methods currently are either too costly and/or time-consuming or are not accurate enough.
- Focusing on the landscape level. It should consider effects on and of the direct environment, go into dialogue with nearby stakeholders and tailor solutions to the specific context.
- Supporting research into multi-purpose forestry and trade-offs. With changing societal demands of our forests, there is a need to investigate trade-offs between different goals of the forest and to research the differences between specialized and multi-purpose forests.
- Continue to research the cumulative impacts of several risk and their interdependencies. Multiple risk agents can impact on forest ecosystems at the same time or in a cascading manner.
- Understanding the temporal and spatial dynamics of biodiversity characteristics in forests. Little is known on the natural variation of biodiversity characteristics in forest ecosystems regarding time (short and long-term dynamic) and space (spatial dynamics).
- Developing tools to adapt to drought and water stress. How to adapt to drought and water stress in forest ecosystems that so far had enough water. Forest owners have to start thinking differently in managing such forests.
- Assessing long-term impacts of forestry measures on biodiversity characteristics in forests. Better knowledge on the consequences of forestry measures on the development of biodiversity characteristics.

Theme 3: Megatrends

- Adapting all parts of the forest-based sector to a changing climate, including:
    - Producers: more active (forest) management is required.
    - Processors: (prepare) for a changed raw material base.
    - Conservation: what was not necessary "right" anymore.
    - Society: (better communication) on the multifunctional functions of forests.
- Understand how to (keep) people in rural areas that can work in forestry in view of depopulation trends.
- The role of Sustainable Forest Management in human health and climate change
- Social innovation tools to foster changes in habits and behaviour, including cultural factors and traditional knowledge. Need of research on balancing the needs of society and capacities of forests.
- Developing new value chains and new business models in multifunctional forests (using wood and non-wood products).
- In some cases, need to put the focus on knowledge rather than on stakeholders. We should analyse the forest research system by looking at how knowledge is produced, transferred and used rather than by looking at how stakeholders interact.
- Governing research results to be transferred to foresters, administration, etc., so that innovation solutions are implemented. How to engage forestry management and owners more in societal development? How to reduce the disconnectedness?

- Developing big data applications to forest management and Artificial Intelligence for better decision making.
- Improve communication on research outputs, need to develop new communication tools to secure better communication between researchers, foresters and forest owners.
- Collaboration at international level and on tropical forests. Globalisation is a megatrend but moving from globalisation to regionalisation will impact forestry at all levels.

BO5: Digital and data technologies in agriculture: R&I for sectoral transformation

Aim of the session

Digital and data technologies are key enablers for increasing the social, environmental, and economic sustainability and competitiveness of the agricultural sector. The importance of data-based solutions in agricultural technologies is steadily increasing and the portfolio of innovative digital applications is changing. Moreover, numerous business and governance models are developing in the agricultural innovation ecosystem, which is driven by Green Deal and Digital Age ambitions, in particular the European Strategy for Data.

This breakout session aimed at exploring how to foster the potential of R&I in the field of digital and data technologies in agriculture and identifying the priorities in the field of technological and social innovation, to enable the agricultural sector and the wider innovation ecosystem to respond to challenges and needs.

Keynote speech

Bertin Martens, Visiting Fellow at Bruegel (Brussels) and non-resident Research Fellow at the Tilburg Law & Economics Centre (Tilburg University, The Netherlands) , opened the session with a keynote on ***The European Strategy for Data Challenges and Opportunities for R&I and Agriculture*** *(*Figure 30*).* This served to set the scene by providing an overview of selected elements launched under the European Strategy for Data[5] and reflecting on related challenges and opportunities for R&I and for the agricultural sector.

Figure 30. Keynote speech by Bertin Martens.

[5] A European Strategy for data | Shaping Europe's digital future (europa.eu)

He explained that the principal objectives of the **Strategy for Data** are the facilitation of data sharing, in particular Business-to-Business (B2B) data trade and competition in downstream data-driven services markets, and the facilitation of the re-use of data for R&I.

Regarding the handling of agricultural data, he raised the question whether the distribution of the gains of data sharing between farmers, who invest into digital technologies, and (digital) service suppliers is fair. He pointed to a market failure resulting from the locked-in of farm data in machines and devices. A lack of data portability, which prevents farms from seeking alternative aftermarket service providers, leads to reduced competition in the provision of data-based solutions in agriculture. Moreover, there would be no incentives for farm data pooling for farmers. Both bottlenecks reduce the potential for innovation.

He reflected on the voluntary **Code of conduct** of agricultural data sharing by contractual agreement, according to which the farm operator as "data originator" would have the right to decide who can access and use the data. The Code of conduct could be overruled by the evolving cross-sectoral legislation, like the Data Act.

The proposal for the Data Act[6], which concentrates on non-personal IoT Data, aims to increase transparency in available data, introduces provisions for contracts between manufacturer / data holder and users, such as farmers. It is expected to solve data lock-in issues as users would have the right to freely access raw data generated during use. A third-part portability right would be introduced subject to payment of collection, storage, and transmission costs. He raised the questions whether those provisions may result in a fair situation – farmers may pay twice for their data: for the device that collects data, and for third-party re-use.

The evolving **Common European Agricultural Data Space** is expected to become "A trusted data space to enable the agriculture sector to transparently share and access production data, open data and other public data, allowing for an increase in its economic and environmental performance." Bertin Martens reflected on the potential of that data space: pooled data across farms is more valuable than fragmented data, but data types and sharing conditions must be clarified. Private vs. social value differences of agricultural data might hinder optimal pooling. A key question for the functioning of the data space, would be, whether farmers have incentives to share their data voluntarily.

"Pooled data across farms is more valuable than fragmented data, but data types and sharing conditions must be clarified" - Bertin Martens

Finally, elements of the **Data Governance Act**[7], were introduced, focusing on the conditions for data intermediation services as "a commercial data sharing service between data holders and users". He highlighted that Art 2(11) of the Act excludes many agricultural data services that aggregate and/or transform data to add value and license their use, or client interaction services offered by a single data holder. He raised the question, whether under those conditions, data spaces can be financially viable without added value.

[6] At the time of the conference, the Data act was still negotiated in the trialogue by Council and the European Parliament. Political agreement was achieved on 28 June 2023 (see https://ec.europa.eu/commission/presscorner/detail/en/ip_23_3491).

[7] European Data Governance Act | Shaping Europe's digital future (europa.eu)

Overview of EU R&I activities

An overview of EU instruments in support of R&I for the digital transformation of the agricultural sector and of relevant projects funded under Horizon 2020, Horizon Europe and Digital Europe Programme (DEP) was provided by representatives of the European Commission, together with a snapshot of forthcoming calls under Horizon Europe and DEP. Attention was devoted to the forthcoming Horizon Europe candidate partnership Agriculture of Data[8], to be funded under the Work programme 2023/24, which aims at supporting sustainable agriculture in Europe as well as policy monitoring and implementation by using the possibilities offered by digital and data technologies in combination with environmental observation and other agricultural data.

The complementarity between funding instruments was addressed: while Horizon Europe supports R&I, under the Digital Europe Programme, innovation, deployment, and capacity building are supported. Thus, e.g., R&I results on digitalisation and data technologies from Horizon Europe could be scaled up with interventions under the DEP, e.g., under so-called European Digital Innovation Hubs. Other relevant measures under the Digital Europe Programme would be the Testing and Experimentation Facilities for AI in agri-food and support to advanced Digital skills. Particular attention was dedicated to the Coordination and Support Action (CSA) funded under the Digital Europe Programme to support the development of the Common European Agricultural Data Space, introduced in the keynote speech.

The approach towards strategic planning followed for Horizon Europe Cluster 6 was introduced, and the importance of the break-out sessions to shape future work programmes was highlighted.

Panel discussions

The panel was composed of four experts*:*

- **Ovidiu Vermesan**, Chief Scientist of the Digital Unit of the Foundation for Industrial and Technological Research, Norway.
- **Kevin Doolin**, Executive Director of the Walton Institute's Applied and Commercial Research Activities, Ireland.
- **Patrick Majcen**, Head of the Legal and Environmental Policy Unit at the Austrian Chamber of Agriculture, Austria.
- **Maria Rosaria Coduti**, Policy Officer, Unit on Data Policy and Innovation of the Directorate General for Communications Networks, Content and Technology of the European Commission.

The Commission representative had the opportunity to supplement the keynote speech with aspects related to the Data Act and the Data Governance Act (DGA), which will both be applied horizontally across sectors. She highlighted that the Data Act would be revolutionary, as it will empower the user of Internet-of-Things (IoT) devices. In the context of the DGA, there will be a pivotal role for data intermediaries, who will act as neutral actors that cannot monetize data, helping to approach the current lack of trust in data sharing.

It will take time to see which impact the two legal acts will have in practice. It would be important that all stakeholders, including the agricultural sector, express their needs in data spaces and become proactive in the "co-creation process", like within the Coordination and Support Action, which is expected to develop an approach towards the data space following a participatory approach.

The other panellists were asked for the **awareness about the Data Act, DGA and data spaces** in the stakeholder groups they represent. The panellists highlighted that there is a different level of

[8] Food, bioeconomy, natural resources, agriculture and environment (europa.eu)

awareness on related "R&I enabler" introduced through legislation among private and public actors in the innovation ecosystem; and also between researchers more generally, start-ups, and "data sharks". It would be necessary for all stakeholders to understand that the DGA will increase trust in data transactions and help reuse existing public-data, data altruism and interoperability. For the agricultural innovation system, it was indicated that the potential of data sharing and the needed "enablers", like skilled farmers, as well as ethical aspects and the value of data are discussed, but less so the concept of data spaces. For the broader agricultural sector, it was pointed out that the discussion on data sharing started long ago. With the introduction of the General Data Protection Regulation (GDPR), farmers were still not able to access their data, as it was not regarded as personal data. The Code of Conduct on agricultural data sharing by contractual agreement would not have really changed the situation of farmers and their data in practice because it´s just a voluntary approach of data sharing with no possibilities of enforcement. **In so far, the Data Act would offer huge opportunities by giving rights to farmers as users of IoT equipment and would also break "data silos" of big companies**. The Data Act and Data Governance Act are strongly interlinked with the forthcoming AI Act[9] and are integral to the EU's comprehensive data strategy. These acts strengthen innovation, foster value creation, and safeguard fundamental EU rights and values.

"Digital skills of farmers would be an essential factor to exploit the potential of agricultural data" - Kevin Doolin

As regards innovation and levers to exploit the opportunities offered under the Data Strategy, **there was wide agreement among panellists that (digital) skills of farmers would be an essential factor to exploit the potential of agricultural data**. It would not be sufficient that farmers have data and certain tools – they must be enabled to use them and ideally also to be involved in the development. With the opportunities of the Data Act to access their data, SMEs will develop tools to process their raw data and create further value for the farmers and the sector as a whole. Support instruments to invest in technologies would exist. At a strategic level, one opportunity which might be envisaged is the creation of links between the emerging data spaces (such as the energy and the environmental data space) as well as the use of data for allowing farms to develop in a resilient manner on a medium- and long-term under consideration of the need to adapt to climate change.

As member of the expert group on model contracts[10] for B2B data sharing accompanying the development of the Data Act, Patrick Majcen was asked to reflect on the **relevance of model contracts in the agricultural sector**, considering the special market structures in the agricultural and machinery sector. There would be two contractual relations to be considered to ensure fair data sharing in the future – one between the manufacturer (data holder) and the farmer (user) to give the farmer access to the data they generate, and another between the farmer and start-up (data recipient) who "promises" the farmer a special service with their raw data. Each of the contract would have its specificities and risks. A model contract developed by a Commission expert group could serve as guidance document for farmers and may increase the trust in model contracts as they are created in a fair and balanced way.

In a final round, panellists reflected on the **greatest needs for R&I (and other actions, such as capacity building or legislation) to exploit the potential of agricultural data for the private and public sectors**. The following aspects were brought forward: a) extending and encouraging standardisation, b) more

[9] https://digital-strategy.ec.europa.eu/en/policies/european-approach-artificial-intelligence

[10] Register of Commission expert groups and other similar entities (europa.eu)

usable data enabling and data analysing tools for farmers, c) setting links between tools and platforms, and d) the synergetic use of agricultural and environmental data.

In this session, particularly questions were made by the audience related to the new and evolving legislation were raised as presented below.

It was inquired how, under the **new legislation, infringements would be traced and policed**. The Commission representative explained that enforcement mechanisms are foreseen and that to a certain extent, it would be up to Member States and the competent authorities how they would implement those regimes. Courts could be used to achieve enforcement. The enforcement would also be part of the evaluation of the regulations. Finally, there would be a role for the European Data Innovation Board to advise Member States and to collect best practices in applying the regulation.

It was pointed to a **lack of recording of incidents in data sharing and tools to prevent incidents**. It was asked whether the view that there is a need for monitoring incidents was shared. The Commission representative pointed out that for both legal acts – Data Act and DGA – reviews would be foreseen based on monitoring the practices in data sharing.

Participants were also interested in learning about competition restrictions under the Data Act. The Commission representative explained that there was a need to balance incentives to innovate and user empowerment. Seeking to reduce the risk of sharing data with third parties, the data recipient would not be able to use the data to develop a competing product. They could, however, offer a service to the user. A participant pointed out that the farmer would already have paid for the machine and the services provided by the manufacturer; the manufacturer would have a return on investment on the machine sales and the services offered and would then have again the right to sell the data. The manufacturer's protection would lie in their patents. Another panellist supported that position and added that the manufacturer already benefits from the data since they can improve their products.

Panellists were asked to share their views on **possible barriers to developing the Common European Agricultural Data Space**. Aspects identified by the experts included a lack of standardization, the risk that the Data Act [at that time still in the trialogue] may give data holders reasons for not sharing their data; user empowerment would have to be ensured, the risk not to consider the needs of all stakeholders in the agricultural ecosystem as well as a lack of a framework for testing and benchmarking, which may further incentivize farmers. It was also highlighted that many projects reinvent the wheel and work in parallel; stocktaking and systematic results screening would be an asset.

The Data Act will significantly affect farmers and the agri-food value chains. This should motivate the agri-food ecosystem to share or use data or provide systems enabling data sharing and continuously evaluate the Data Act's and DGA's impact on their businesses.

Co-creation of R&I needs

The interactive co-creation part in the breakout sessions took place at nine round tables with around ten persons each (Figure 31). In a first round all tables discussed the following two questions:

1. What are the main R&I needs to enable the agricultural sector to engage with and fully exploit key elements introduced/ reinforced under the Strategy of Data, including data spaces, Data Act and Data Governance Act?
2. What are the main opportunities for R&I in agriculture introduced/ reinforced through the European Strategy for Data?

For each round table the top priority R&I needs and opportunities were identified.

In a second round, all round tables discussed the following two questions:

3. What needs to be done/ which mechanisms need to be deployed to implement the R&I activities identified under the two previous questions in the public and private domains?
4. What has already been achieved by the innovation ecosystem to exploit the potential of data for the agricultural sector?

For the third question, each table identified the most important activities to be carried out/ mechanism to be deployed to implement the identified R&I activities needed to exploit the potential of agricultural data.

The co-creation process revealed that the subject of agricultural data and data technologies is complex. The new and evolving legislation led to many questions and discussions. Before the conference, many participants were unaware of the implications of the Data Governance Act and the Data Act for R&I and how far-reaching the implications might be for the agricultural sector. One key lesson which can be drawn from this session is that awareness raising and capacity building among researchers on new and evolving legislation is essential to ensure that R&I results fit well into the legal reality. Such capacity building would allow for better development of horizontal/cross-sectoral legislation in data and data technologies as it regards the assessments of possible implications for the agricultural sector. The time of the co-creation process was too limited to discuss all questions in detail, and the topics still need to be conclusively discussed.

Figure 31. Co-creation during BO5.

As regards R&I needs to enable the agricultural sector to cope with and exploit elements introduced or reinforced under the European Strategy for Data, **the most important R&I needs identified include:**

- Gains in standardisation of data formats and applications,
- Increasing interoperability,
- European-wide applicable approaches, structures, and governance, and

- Incentives for data sharing (including practice-oriented ones).
- Implementation of data platforms and open data models.
- Advisory services “data SPIN doctor” for farmers, including new continuous training measures.

The list of identified other R&I is long. It covers a range of aspects, such as business models enabling start-ups to better generate value, the use of edge AI and connectivity technologies the advances in natural sciences and assessing the overall impact of data technologies.

On the opportunities for R&I through elements introduced/reinforces through European Strategy for Data, including increased opportunities for the monitoring of data flows and Government-to Business and Business-to-Government (B2G) data sharing:

- More data available and accessible for research, as well as for policy-making and sustainable agricultural production,
- Identification and interlinking data spaces,
- The development of self-sovereign identities to enable cross-border transactions and the access of European farmers to data spaces across Europe.
- Access to farm “raw data”.

In addition, a number of very specific opportunities were identified, for example, **activities/ Mechanisms to implement R&I activities**:

- Consideration of the regulatory framework in R&I,
- Capacity building among scientists and stakeholders on EU legislation,
- Reducing fragmentation in the data ecosystem,
- Involvement of stakeholders, farmers in particular, in R&I activities (Multi-Actor Approach),
- Considering the uptake of innovative solutions in the design of R&I projects,
- Enabling data sharing,
- Interdisciplinarity, including legal sciences, in research, and
- Studies on stakeholders’ acceptance of approaches in data sharing.

Within the discussion in the groups, it was frequently highlighted that it would be essential to round off R&I results, and not only fund R&I but upscale to achieve synergies between initiatives. To achieve this, organising “Cluster meetings” between R&I projects appears to be essential.

Participants pointed to several R&I achievements in data technologies for agriculture. Frequently, applications for farmers were mentioned, particularly in precision farming. Also, the work on data marketplaces, drones, GPS, and Earth observation-based solutions. An overview can be found in the following factsheet. Overall, it was highlighted that a systematic assessment of R&I results in this field would add further value to the achievements of all stakeholders.

BO6: Rural opportunities

Aim of the session

The aim of this breakout session was to bring together scientists, researchers, rural stakeholders, and policymakers to discuss how R&I can support rural areas and communities to develop or regenerate in a sustainable, balanced and equitable manner. Thus, during the session participants were able to explore Research & Innovation (R&I) solutions and identify needs and priorities for future R&I programming.

The keynote speech focused on the status of rural areas, and the presentation on the current R&I agenda, as well as the panel discussion inspired the co-creation exercise that followed. Participants were asked to identify the R&I needs of rural areas and communities and how to address them. The session highlighted the important role that rural areas have played in our societies and will play in the future.

Keynote speech

Emilia Schmitt, Scientific Coordinator of Horizon 2020 (H2020) project MOVING "Mountain Valorisation through Interconnectedness and Green growth" (Figure 32), introduced the breakout session with a positive outlook on rural areas and rural communities. Rural areas cover approximately 76,4% of EU land and 24,1% of its population. In fact, these territories are very large and diverse but the population that inhabits these areas is few. This causes less tertiary education, lower GDP rate and opportunities for the people living in these areas.

"Rural areas are where we have our roots, they are precious because they are areas where culture is forming and coming from. Heritage, tradition, folklore, reservoir of biodiversity and natural resources are only some of the services of rural areas" - Emilia Schmitt

Emilia Schmitt highlighted the positive and negative trends observed in rural areas. The workforce is decreasing mainly due to economic reasons. Indeed, several rural areas are no longer attractive places for young people. However, **with the pandemic, we have witnessed that opportunities may arise in rural areas. Being less connected places, they preserve more sanitary security, while digital connection brings new opportunities.** However, rural areas should not be seen as a separate entity from urban areas.

The Horizon 2020 project MOVING has a focus on mountain areas and on building capacities and co-developing in a bottom-up participatory process with value chain actors, stakeholders and policy makers in order to establish new or upgraded/upscaled Value Chains that contribute to resilience and sustainability of mountain areas. The project works with communities of practice in 23 regions, where different participatory activities are fostered.

Figure 32. Keynote speech by Emilia Schmitt. Source: MOVING H2020 (@MOVINGH2020) / Twitter.

Overview of EU R&I activities

The European Commission presented what has been done in R&I on rural areas, providing a comprehensive overview of the past, present and future activities under Horizon 2020 and Horizon Europe. Under Horizon 2020, several projects were funded and implemented in rural areas. These projects focused on social innovation, territorial approaches and linkages, business and innovation, digital transition, generational renewal and small farms. The currently funded projects under Horizon Europe are working on improving indicators and evidence, boosting women-led innovation, training for rural innovation, improving labour conditions in agriculture and rural areas, digital transition and small villages. Finally, the upcoming opportunities under Horizon Europe Cluster 6 "Food, Bioeconomy, Natural Resources, Agriculture and Environment" relevant for rural areas were presented.

Panel discussion

Four panellists took part in the panel discussion (Figure 33):

- **Spyros Fountas**, Professor at the Agricultural University of Athens, Greece, and coordinator of the Horizon Europe project FUTURAL.
- **Petri Kahila**, Research Diverctor at the University of Eastern Finland, and participant to the Horizon Europe project RUSTIK.
- **Wallis Vandebrock-Goelen**, Senior Expert attached to the Deputy Director General for urban and territorial development of the Directorate General for Regional and Urban Policy of the European Commission, inclusive growth and international relations and Head of the REGIO project group on the long-term Vision for the EU's Rural Areas.
- **Marta Guadalupe Rivera Ferre**, Research Professor at the Spanish National Research Council (CSIC), and coordinator of the Horizon Europe project SWIFT.

The panel discussion started with the following question: *"From your experience, what are the main trends and drivers in rural areas?".* In replying to this question, Spyros Fountas identified main areas of interest: **the technological infrastructure (which allows broad connectivity), the demographic shift, the economic diversification, the sustainable development, the access to essential services (e.g. mobility, health systems) and collaboration with the community**.

Petri Kahila, highlighted how rural areas are different throughout the EU and the rural transition processes they are going through. In this, there is a cope mechanism and a resilience shown by rural areas in adapting and facing those transitioning challenges. It should be considered **how to face trends and transitions of each rural area, for example with land diversification.** Areas with no level of connective goods might be the least capable of going through this transition.

On the other side, **Marta Guadalupe Rivera Ferre**, added that rural areas are impacted strongly by deindustrialisation and climate change as there are different sensibilities than in urban areas. Moreover, she questioned the perception and interconnection of rural and urban areas. A final point raised was related to the **difficulties people face in rural areas: overall they are not offered the same quality of life of people living in urban areas, due to abandonment, less infrastructure and services**. Indeed, she identifies as main trend "a masculinization of people in rural areas": men are more eager to stay in rural areas because they fit in the role that these territories require, while women are leaving as their role is not mirrored and do not find a common understanding in these territories.

Wallis Vandebrock-Goelen stressed out the importance of the definition of rural areas and that at the moment the Commission for statistics uses the one adopted by the Eurostat. She reported that in the Long-Term Vision for Rural Areas the focus is on democracy and demography and the role of demography in rural areas is pivotal for improving these territories. In rural areas, more people are at risk of poverty, there are higher gender gap rates in employment, young women are more likely to leave rural areas than men. Cohesion Policy is therefore crucial in these territories. In the Directorate General of Regional and Urban Policy of the European Commission, there is the priority to find solutions and come out maximizing territorial cohesion and urbanism. Indeed, there should be no distinction between urban and rural areas but a continuum, where People living in rural areas should not feel left behind.

Figure 33. Panel discussion during BO6

For the second question of the panel discussion "***From your experience how can EU R&I enable the sustainable development of rural areas and rural communities?",*** Wallis Vandebrock-Goelen highlighted that the EU Cohesion policy has a convincing, place-based approach and there should be not a single fit for all solution as there is much diversity among rural areas. Moreover, she also stressed the importance of promoting tangible innovations and the contribution of Member states in rural

areas to business and research. The strength should rely on a better understanding of the potential that there is in innovation.

Marta Guadalupe Rivera Ferre added that access to natural, human and symbolic capital is important in rural areas. For Petri Kahila, the EU is a major contributor to innovation and adaptation is important as well as renewal where we can adapt but we also need to be renewed. Spyros Fountas also highlighted the lack of R&I in rural areas where the challenges to keep people in these territories, make them happy and how to bring people back, especially the youth, should be central questions. Knowledge exchange and collaboration should be an incentive, as there is also lack of education, of encouraging entrepreneurship and of boosting skills.

"The challenges to keep people in these territories, make them happy and how to bring people back, especially the youth, should be central questions" - Petri Kahila

The audience asked the panellists to elaborate on the relation between fragmentation and degradation of the land with reference to the region of Flanders in Belgium.

Co-creation of R&I needs

In the last part of the breakout session "Rural opportunities", the 37 participants had the opportunity to actively contribute and have a voice for the identification and prioritization of R&I needs and gaps related to rural areas and communities.

Divided into 5 tables, participants discussed together and engaged in a debate around the same following questions:

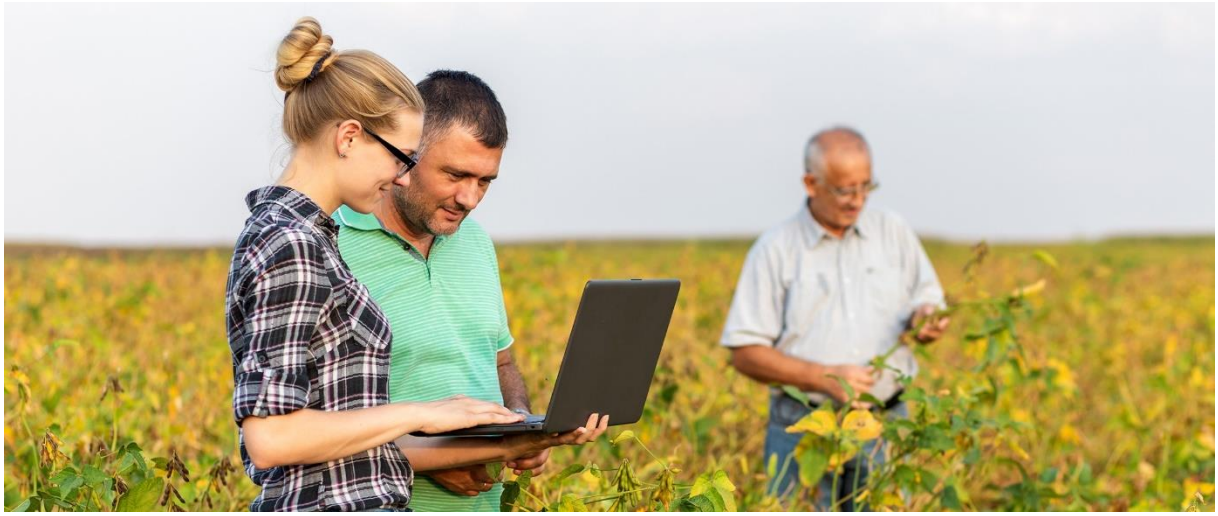
- What are the R&I needs to address the challenges of rural areas and communities?
- How should those needs be delivered through R&I?

The following were the **main findings brought forward by the participants**:

- Need to identify the triggers that retain and attract young generations in rural areas. In order to deliver this need, participants suggested analysing moving trends over time and to research the reasons that make people stay or not in a rural area. Moreover, participants addressed the role of remote working hubs in rural areas. These hubs allow people to have the same professional experience as colleagues in urban areas as they still engage with each other and create a professional network. Related to the job markets, R&I should make the countryside alive by questioning which jobs would be perceived as more interesting and appealing. In addition to this, to evaluate the attractiveness of rural areas, interviews should be conducted to gather and understand opinions of young people as well as to include and support young farmers granting generational renewal in agriculture.
- Find ways to deal with hyper-mobility and how to prepare rural areas for the future: once there is no more space for the people in the cities, a sort of natural migration will happen back to the rural areas. For this reason, it is important to prepare rural areas for the future with smart infrastructure connecting people with economic opportunities. This can be achieved through regeneration, scale-up buildings, business models and pilot projects that ensure connectivity, as well as communication activities that show successful stories in the areas.
- Bolster education in rural areas. Education should be encouraged through school and bottom-up programs by making local communities the protagonists and empowering them in acquiring

knowledge about resources and values in their territories. Moreover, farmers should also be trained in particular when it comes to the use of new equipment and skills. As a consequence, R&I should identify projects that propose innovative ways for closer collaboration between research and community and to better understand the learning process in rural areas. More specifically, participants suggested to include in Horizon Europe projects skills and education activities, to fund projects that focus on new job opportunities, new skills development courses and to create e-learning solutions for up-skilling. There should be more investments into intensive practical innovative peer-to-peer learning programmes and more actors that can take the lead should be involved: e.g. the co-creation of a consortium with industrial, research and farmers organizations in rural areas for the transfer of technologies and better acceptation for the long-term.

- Defining rural areas and integrated (nexus) territorial development. In order to do so, the Long-Term Vision Action plan, LETMO place-based approaches and polycentric model (small-medium cities feed rural areas), the functional rural areas 8th cohesion report will contribute to addressing this challenge, as well as through maximization of rural urban linkages continuum.
- Develop tools to change perspective on rural areas and the perception society has of these territories. This can be achieved through research projects analysing current perspectives and providing tools that will enable the change in value perception and once again through education by facilitating and raising awareness with the media, arts and social media influencers.



BO7: Bridging the gap between R&I and practice: tools and skills for today's and future generations

Aim of session

Agriculture, forestry and rural areas need to speed-up their twin green and digital transition through knowledge, innovation and skills. It is essential to deploy knowledge and innovation wider and at a faster pace to achieve the progress required by the European Green Deal and the CAP. R&I have to become also more responsive to the actual needs and context in real life.

More effective **Agricultural Knowledge and Innovation Systems (AKIS)** are key to close the gap between science and practice, and to develop the right skill set. AKIS today uses diverse tools that rely on place-based innovation and encourage knowledge exchange yielded from R&I activities. These include the well-tested and successfully applied multi-actor approach, EIP-AGRI operational groups, thematic and advisory networks, and new tools such as living labs and lighthouses/demo farms.

Through presentations, a panel discussion and a participatory co-creation exercise, this breakout session explored the opportunities to improve the landscape of R&I actions and tools to bridge the gap between research, innovation and practice and provide the right skillset for farmers, foresters and rural communities, thereby equipping them for the sustainability challenges of today and tomorrow.

Keynote speech

Anikó Juhász, Deputy Secretary of State of the Ministry of Agriculture of Hungary, former co-chair of the SCAR Strategic Working Group on AKIS of the Standing Committee of Agricultural Research (SCAR-AKIS SWG) and director general of AKI (Research Institute of Agricultural Economics, Budapest, Hungary) gave an inspirational keynote speech on "*the challenges and opportunities related knowledge, innovation and skills supporting farmers, foresters and rural communities in the twin transition – strengthening AKIS under the CAP*" (Figure 34).

Figure 34. Keynote speech by Anikó JUHÁSZ

She set the scene by referring to the challenges for farmers, foresters and rural communities posed by the green and digital transitions. For the **green transition**, farmers, foresters and rural communities, who are immediate managers of natural resources, need to deliver on the ambitious environmental objectives of the CAP and related targets set by the European Green Deal, and in particular farm to fork and biodiversity strategies. To name a few, by 2030 they need to reduce by 50% the overall use and risk of chemical pesticides and reduce use by 50% of more hazardous pesticides; achieve at least 25% of the EU's agricultural land under organic farming and a significant increase in organic aquaculture; reduce sales of antimicrobials for farmed animals and in aquaculture by 50%; reduce nutrient losses by at least 50% and reduce use of fertilisers by at least 20 %, while ensuring no deterioration in soil fertility. As regards the **digital transition**, based on the case of Hungarian farmers, only around 38% of them use digital tools. The main factors that influence the use digitalisation are size of the farm, education, and age. Larger, with higher educational degree and younger farmers tend to use the digital tools more often than the smaller, without educational degree and older. Although 28% of the machinery used on the Hungarian farms is equipped with precision solutions, only 8% of the farmers use their full potential and applies real precision agriculture.

"Farmers need knowledge and skills, AKIS needs to be trusted by farmers, and society needs to trust farmers" - Anikó Juhász

She highlighted that the triple challenge for the twin – green and digital – transition is that farmers need skills, AKIS needs to be trusted by farmers, and society needs to trust farmers. For that, it is important to reinforce AKIS that puts farmers at the centre and integrates other actors ensuring knowledge flows inside Member States (MS) and across borders (Figure 35).

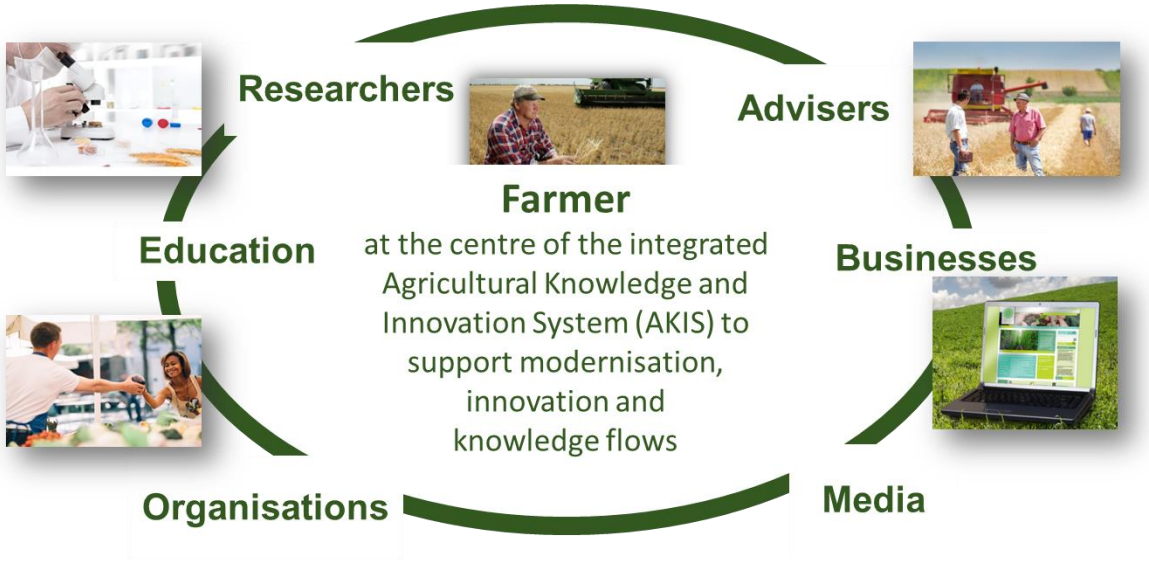


Figure 35. Agricultural Knowledge and Innovation Systems (AKIS) include all people and organisations (farmers, foresters, farmers' and foresters' organisations and cooperatives, advisors, researchers, businesses, NGOs, etc.) that generate, share and use knowledge.

AKIS coordination is key to bring actors together on a structured and regular basis, creating continuous interaction to speed up knowledge exchange, knowledge flows, innovation and most of all: implementation in practice. The CAP is an important instrument to strengthen AKIS at national and EU

levels. Therefore, under the CAP Strategic Plans, MS have planned measures to support the cross-cutting objective of the CAP to foster knowledge exchange, innovation and digitalisation. In details, 25 MS included in their Strategic Plans measures dedicating around 2% (€2.1 billion) of public funding to foster knowledge exchange and information. In terms of innovation, 26 CAP Strategic Plans foresee support for over 6.600 new EIP-AGRI Operational Groups. Besides, many CAP Strategic Plans boost digitalisation by combining a wide range of measures combining cooperation, communication and investments with the aim to reach 274.000 farms.

Overview of EU R&I activities

The European Commission showcased in a nutshell what has been achieved so far under Horizon 2020 and Horizon Europe in terms of strengthening AKIS and thereby enhancing human capital and boosting innovation systems for the green and digital transition. In total under Horizon programmes, the Commission invested almost €300 million in around **70 R&I projects** and implemented interactive innovation model through **multi-actor approach** (for more details refer to the following factsheet). As Commissioner Wojciechowski illustratively defined multi-actor approach in the conference's opening speech that "*we do not only do R&I for farmers, but also **with** farmers*". The multi-actor approach is about putting the end-users at the centre of the R&I activities from the beginning to the end of the project, not as a study objects, but as active participants / or even better "co-creators" that share their tacit knowledge and/or entrepreneurial skills, and genuinely co-create knowledge and innovations that respond to real needs on the ground. The multi-actor approach (MAA) has been improved under Horizon Europe in the following three ways. First, the definition and requirements of the MAA included in the introduction of the work programme have been revised and simplified. Second, MAA became an eligibility criterion in the evaluation of proposals. Third, the multi-actor approach has also been streamlined throughout all sectors under Cluster 6 including agriculture, forestry and rural areas, food, bioeconomy, environment, fisheries and aquaculture, etc. As a result, in the two consecutive Cluster 6 Work Programmes, 44% of the topics (worth more than 40% of the budget) require MAA. In total, under Horizon 2020 and Horizon Europe, more than 350 multi-actor projects have been funded so far (Figure 36).

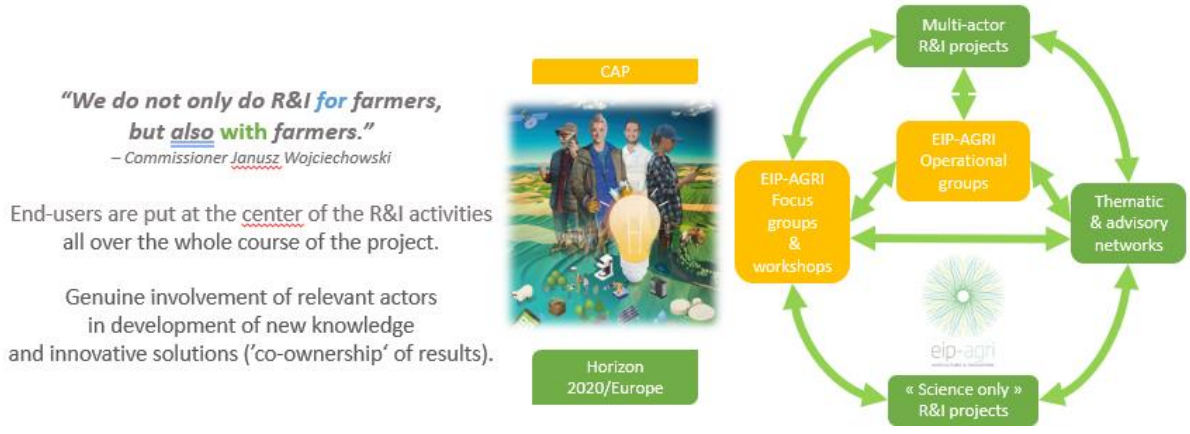


Figure 36. Interactive innovation model implemented by multi-actor approach applied in Horizon and CAP funded projects.

In addition to the multi-actor approach, the Commission has also put a lot of effort into sharing new knowledge and innovative solutions with the practitioners – farmers, forester and rural communities -

among others, by developing and implementing **three tools: thematic networks, advisory networks and EU-wide knowledge reservoir** (Figure 37).

Figure 37. Definitions of thematic networks, advisory networks and EU-wide knowledge reservoir.

To speed up innovation and maximise impact on the ground, it is also extremely important to innovate in places where people live and work, so that the innovations are adapted to the real context. Therefore, the **place-based innovation** has been supported under CAP throughout the EIP-AGRI Operational Groups and under Horizon by launching new tools, such as living labs and lighthouses in the **Mission 'A Soil Deal For Europe'**. **Living labs** are groups of real-life sites in which diverse actors experiment and test solutions for soil health and agroecology in a co-creative manner. **Lighthouses**, on the other hand, are individual sites, such as a single farm, for demonstrating, training and communicating about innovative best practices. As Rogier Schulte said in his inspirational talk at the beginning of the conference, lighthouses "*shed light on the pathways towards sustainability for other farmers to follow*". The European Year of Skills 2023 is a reminder for us that having the right knowledge and innovation for the sustainable transition is not enough. Farmers, foresters and rural communities need also the right skills to use them with impact. To ensure that the EU farming and forestry sectors have what it takes in terms of skills to use the opportunities offered by R&I, several Horizon and Erasmus+ projects are ongoing (e.g., **ModernAKIS,** FIELDS and I-RESTART). There is also the EIT Food with educational activities that help food systems' actors to acquire the right skills. However, a question remains, *what else can we do under EU R&I programmes to help farmers, foresters and rural communities develop and use the right skillset?*

Panel discussion

The panel (Figure 38) focused on discussing **the fitness of the Horizon tools** for deploying knowledge, innovation and skills at wider scale and faster pace to achieve the progress required by the European Green Deal and involved four speakers:

- **Susanne Von Münchhausen** representing the perspective of a **researcher**. She works at the University of Applied Research Eberswalde and is project coordinator of Horizon 2020 project LIAISON and Horizon Europe project PREMIERE.
- **Daniel Rossi** representing the perspective of a **farmer organisation**. He is Chairman Copa-Cogeca, largest EU farmer federation R&I WP and Delegate R&I Confagricoltura, participant in many Horizon projects and co-coordinator ERASMUS+ FIELDS and I-RESTART projects.
- **Jacek Podlewski** representing the perspective of a **farmer**. He is CEO farm with more than 5.000 ha, implementing innovative solutions such as precision farming.

- **Inge Van Oost** representing the perspective of a **policymaker**. She is a senior policy officer responsible for coordinating AKIS in CAP Strategic Plans in the European Commission Directorate General for Agriculture and Rural Development.

Figure 38. Panellists and audience of BO7.

Susanne Von Münchhausen highlighted that the multi-actor approach as eligibility criterion relevant for a large number of upcoming Horizon Europe call requires a different mindset and way of working for those coordinating and participating in a multi-actor proposal and project. Mixed types of (new) partners with practice-orientated competences need to be involved early (e.g. 6 months prior to submission of the proposal). Their interests, needs and experiences 'materialise' in (nearly) all areas of the proposal and project, which means needs assessments and participatory methods are needed in order to ensure the involvement of all relevant perspectives at all stages. Scientific leaders will be forced – earlier or later – to change their way of communication and decision-making when joining a multi-actor consortium.

She noted also that **bridging the gap between research and practice only works when the needs and interests of scientific and non-academic partners are taken into account on equal levels**. To ensure such a communication and collaboration, capacity building is needed – also for the scientists. All partners engaged in the communication between the different types of consortium partners need to have a certain set of skills and competences to ensure multi-actor co-creation. Competences include – not only but also – the use of participatory tools such as workshop methods, polls, and other methods that ensure everybody will contribute as expected from the outset of the multi-actor consortium formation. Many participatory tools that help to ensure such a multi-actor communication and collaboration in practice are available, e.g., in toolboxes or trainings for team building, workshop facilitation, stakeholder involvement etc. LIAISON has prepared 5 How-to-Guides and one guideline that leads to a variety of facilitation and self-assessment tools, as well as 15 videos that give evidence

of inspiring co-innovation partnerships from across Europe. Moreover, the LIAISON team has involved the SCAR-AKIS SWG in the preparation of a policy brief for an EIP-AGRI capacity development framework in 2022. This policy brief is available for download.

The PREMIERE project is preparing workshop and communication tools such as multi-actor role plays, a serious game, brokerage events, train-the-trainer seminars, how-to-guides, videos etc. for experienced EU programme participants as well as newcomers in the field of Horizon multi-actor proposal development.

Inge Van Oost urged that we must reduce the time from research to impact from about 20 years (if any impact), to maximum 5 years. Therefore, since 2011 the Commission together with the SCAR-AKIS SWG has been developing and implementing the interactive innovation model. This means that the projects must respond to the needs from practice, that complementary expertise must be brought together in the consortium, and that wide communication and dissemination is considered an essential part to share the ready-to-use outcomes to those who need them. However, programming such projects alone is not enough. **We need an well-functioning AKIS where actors know each other, regularly meet and exchange views, needs and knowledge.** The 2023-2027 CAP policy designed the improvement of the national AKISs as a cross-cutting objective to support all other specific objectives, be they economic, environmental or social.

"Solutions do not come to you, you have to practice how and where to find them" - Inge VAN OOST

This is also why we need to encourage and organise knowledge flows and contacts, which is possible through thematic and advisory networks. She pointed out several ways to improve the Horizon networks. First, impartial advisors should be known and easily found through the use of publicly managed lists of advisors in each country, indicating their thematic specialisation and specific expertise. This is an AKIS task for CAP managers and is currently in development. Second, all the knowledge collected by thematic networks and multi-actor projects, both at EU level under Horizon, and also at national/regional level funded by the CAP, should help agricultural practice to become more sustainable. Specialist advisors should be in frequent contact to exchange with specialist researchers, and thus be in a position to help their colleagues field advisors. Research and practice must know each other and collaborate, building knowledge reservoirs with practical solutions free to use by any AKIS actor. Another working point, not only at the level of each member state, but also at EU level, we are building such EU-wide knowledge reservoir (EU-FARMBOOK) that aims to bridge the gap between research and practice. Third, it is key to further foster synergies between CAP and Horizon, for example by continuing connecting the thousands of EIP-AGRI operational groups and share their results across borders by means of dedicated thematic networks.

She noted that improving skill building is another challenge linked to improved AKIS and intensified knowledge flows. What is missing is the cross-fertilisation between research, advice, practice and education/training/skill building. If we do not improve our training/education systems, farmers will not be attracted to come to a course, while administrations complain that they offer courses but the farmers do not want to come. For any education or skill building action, it will be the quality and usefulness of the courses which will be instrumental to their success. If they do not bring up-to-date information, users will not be interested. She provided several concrete recommendations: (1) make shortcuts from vocational training and from university or schools to practice experts; (2) involve

advisors in teaching activities; (3) involve students to look for solutions for challenges on real farms; (4) create specific university curricula to teach the future advisors how to use knowledge flows and learn them how and where they can find useful knowledge; (5) focus also on entrepreneurial skills as they are key in our current world.

Jacek Podlewski, as a CEO of a farm that has more than 5.000 ha and applies different innovations was asked what skills farmers and agriculture workers need? He highlighted that **there has been a shift in thinking from intensification to optimisation of farming systems**. The optimization in farming is crucial not only for cost reduction but also for ecological reasons and increasing crop yields. This shift requires a completely new range of skills. For optimisation, we need data and tools. The innovative precision agriculture solutions applied on farms generate enormous amount of data. The data needs to be analysed and used to further optimise the processes. **Farmers and agricultural workers need a wide range of diverse skills to be able to use the digital farming solutions and advanced analytical skills to make sense and utilise the data to optimise their production systems**.

"There is a shift from intensification to optimization of farming systems that requires different kind of skills." – Jacek PODLEWSKI

Daniel Rossi added that employment in bioeconomy will not increase significantly in absolute terms, but at the same time job qualification levels will further increase. There will be more vertical and horizontal integration of sub-sectors, e.g., farmers with the food industry, agri-food energies (renewables), new bioprocessing and biomaterials, new horticultural/legumes/meat technologies (aquaponic, hydroponic, soilless, cultivated in labs/biorefineries). **These trends imply different kind of new skills that farmers and agriculture workers need to develop.** When asked what new R&I tools and approaches can be provided by the EU to address the need, he supported the MAA applied to R&I projects and recommended to look also beyond EU R&I programmes and focus on synergies with other programmes in order to: (1) promote cooperation among stakeholders in the design, management and financing of the educational agri-food system; (2) strengthen responsiveness to change towards new occupational profiles and skills; (3) provide adequate remuneration and social protection for apprentices; (4) promote cooperation at micro-level between schools and employers organizations; (5) support VET reforms and fiscal incentives to companies at national level. He highlighted also a concrete solution to develop and use a European approach to micro-credentials in the agricultural and food sector. For them, it is also important to monitor the situation by looking at diverse Key Performance Indicators. New Partnerships and the Pact 4 Skills can be good opportunities to boost the up skilling and re skilling transition in the agrifood sector.

Co-creation of R&I needs

The last part of the breakout session consisted of a co-creative discussion to harvest R&I needs in the area of the session from the approximately 90 participants. The discussion was conducted in four themes with two questions asked in each of them. The participants first provided their ideas to these two questions and then collectively discussed and prioritised them.

Theme 1: Providing the right skillset

The participants were asked the following questions:

- What research (new knowledge) do we need to provide farmers, foresters and rural actors with the right skillset?
- What innovative solutions / tools do we need to support farmers, foresters, rural actors in developing the right skillset?

The participants highlighted that it is important to first invest in research on what skills are/will be needed and how to best connect knowledge sources to building up the required skills, considering the diversity of farmers and farming systems across the EU.

In terms of innovative solutions, the participants proposed to: (1) develop a dedicated ChatGPT with answer to questions on challenges and opportunities related to the green and digital transitions in farming, forestry and rural areas; (2) launch a peer-to-peer online learning platform for farmers, foresters and rural communities to support them in developing the right skillset; (3) include practitioners and advisors in agricultural schools' curricular, i.e., invite them to give lectures on concrete themes of their specialisation. Moreover, the agricultural education/training systems should be improved.

Theme 2: Improving multi-actor approach (MAA)

The participants were asked the following questions:

- How to improve the implementation of the MAA at programme level?
- How to improve the implementation of the MAA at project level?

To improve MAA at programme level, the participants suggested to focus efforts on communicating about the MAA, thereby increase understanding of the definition and requirements among the different actors. The communication activities should include brochures with best practice examples and dedicated workshops.

At project level, the participants recommended to include a mandatory box in the application form to provide information how MAA will be implemented in the projects as basis for the eligibility check. In addition, the participants recommended to follow up how effective is MAA implemented by checking it carefully during the lifecycle the project, in particular during the periodic review process. There is a need also to improve preparation and exploitation of the practice abstracts.

Theme 3: Boosting place-based innovation

The participants were asked the following questions:

- How to improve the impact of existing tools that support place-based innovation?
- What new tools need to be developed to boost place-based innovation?

As regards boosting placed-based innovation, the participants proposed to improve the living labs by fostering innovative cooperation between farmers and related businesses at the level of a territory not focusing on individual sectors. It was also recommended to support network of farmer- and/or consumer-led living labs seen as a future oriented business model. It was recommended to foster exchange of knowledge generated in the different living-labs functioning across the EU. The audience provided also idea for a new tool, namely farmer-led discussion groups in a given territory on problems faced in practice and potential solutions.

Theme 4: Advancing knowledge reservoir & networks

The participants were asked the following questions:

- How to improve the impact of EU knowledge reservoir and existing Horizon networks?
- What new Horizon networks need to be developed to bridge the gap between R&I and practice?

The participant recommended to connect the different Horizon networks (thematic and advisory networks as well as the EU wide knowledge reservoir) to the forthcoming established partnerships on agroecology, agriculture of data, animal health and welfare and sustainable food systems.

Several new ideas for Horizon networks were proposed, including: (1) a network of pioneer/champion farmers connected across the EU; (2) a demonstration network for innovative solutions developed under Horizon and applied successfully in practice; (3) a network with new business models that support sustainable farming.

BO8: Social Sciences and Humanities for resilient and sustainable agriculture and forestry

Aim of the session

The aim of the session was to assess the role, the relevance and effectiveness of SSH in IA3 of cluster 6 and to identify possible improvement paths and new topic ideas. The session covered specific thematics organized around guiding questions: How do farmers and foresters behave in an ever-changing environment? Which are the strategies and tools they use to manage risks? How working conditions evolve in their farms and forests? how they tackle the difficulties to attract newcomers, the lack of workforce, the pressure of climate change, food security, new sustainability objectives and new legal requirements, the consumers' behaviour change, technological developments, the gender and other issues? This session explored how to boost social sciences and humanities (SSH) and behavioural sciences in research & innovation to identify barriers and opportunities to face these challenges and so to enhance the resilience and attractiveness of the sector.

Keynote speech

Kristina Blennow, Professor at the Swedish University of Agricultural Sciences (Figure 39), outlined the key role that SSSH play in helping farmers, foresters and rural communities to adapt to new challenges and to benefit from new opportunities of the sector. She highlighted that since we usually talk about the need for individuals to make change happen, we need to reach to the individuals if we want a change in their behaviour. A better understanding of the individual and local perspectives can provide tools for farmers as well for the whole society to help deal with the current challenges.

Figure 39. BO8's Keynote speaker Kristina Blennow.

Using the example of climate change, she noted that it impacts the working environment and attractiveness of the agricultural and forestry sector. Individual decision-making in response to climate change requires strong belief in the "local impacts" of climate change. "Local experiences" can be as influential as scientific evidence to shape people's world view through. The knowledge of the drivers and strategies of local decision-making provides opportunities for bridging the gap between science and practice, but also poses challenges due to variation.

"We need to reach to the individuals if we want a change in their behaviour" - Kristina Blennow.

This kind of "local experiences" do also provide tools to take advantage of technological developments since in order for such developments to be useful in practice, we need practitioners that can make use of new technologies.

Overview of EU R&I activities

The European Commission presented an overview on how Horizon Europe Cluster 6 addresses SSH in agriculture, forestry and rural areas. SSH H research is essential for understanding the complex social and cultural factors that shape agricultural practices and outcomes, and for developing sustainable, equitable and resilient agricultural and forestry systems.

SSH encompass a wide range of disciplines such as sociology, economics, psychology, behavioural science, political science, history, anthropology, demography and cultural sciences. Figure 40 provides an overview of the disciplines included in Horizon 2020 projects that include SSH activities and that cover agriculture, forestry and rural areas.

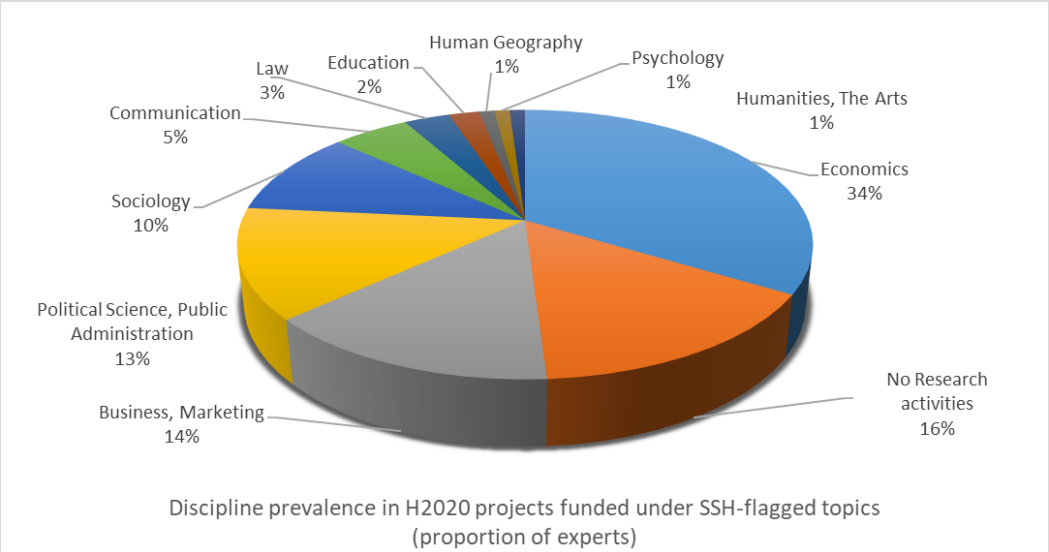


Figure 40. Disciplines in R&I projects funded under SSH-flagged topics.

SSH can enhance the resilience and attractiveness of the sector, help identify barriers and lock-ins to the adoption of new agricultural technologies or practices and develop strategies to overcome these barriers. SSH also provide insights into the cultural meanings and values associated with different foods and farming practices, which can inform efforts to promote sustainable agricultural systems, help ensure that agricultural policies and programmes are responsive to the needs of society in rapidly changing environment.

In terms of integration of the SSH disciplines in the EU R&I activities, we are assisting to an increase in the last decade. Under Horizon 2020 (2014-2020), SSH has been integrated as a cross-cutting element in the scope of some calls. The inclusion of SSH disciplines is considered an added value, so to highlight their presence, topics (calls for proposals) have been flagged to help interested applicants identifying them. For example, in 2018, 22 out of 34 topics under Societal Challenge 2 were flagged for SSH, leading to 44 projects with a budget of EUR 299 million of which EUR 51 million went to partners in

the area of SSH. 176 out of 943 project partners operated in the area of SSH. Belgium, Italy, France, UK, Germany and Spain were the countries with more SSH participation.[11]

Under Horizon Europe (2021-2027) SSH integration has become deeper at cross-sectoral level. SSH has been fully integrated across all clusters of Horizon Europe, including specific and dedicated activities such as Missions and Partnerships. SSH has been integrated in a holistic approach, covering the entire cycle from co-creation and co-design of calls for proposals to the selection and implementation of resulting projects. In addition, there are currently two levels of integration: SSH as a specific requirement (when main focus of the topic) or SSH should be part of the scientific methodology (when indicated as part of the topic scope).

The efforts to strengthen SSH integration in EU R&I in through Cluster 6 of Horizon Europe contributes to increased SSH presence and intensity in projects. However, there is potential to further improve SSH integration and coverage as the progress is uneven, and the overall share of SSH participation is still relatively low in many respects.

Panel discussion

The panel was composed of three speakers (Figure 41):

- **Erwin Wauters**, Senior researcher in the Social Sciences Unit of the Flanders Research Institute for Agriculture, Fisheries and Food (ILVO), and participant to the Horizon Europe project ENFASYS.
- **Mark Redman**, co-owner and Director of Highclere Consulting SRL, and participant to the Horizon 2020 Project FARMWELL.
- **Karen Fabbri**, Deputy Head of Unit in the Bioeconomy and Food Systems Unit of the Directorate General of R&I, European Commission.

The discussion in the panel was organized around two key questions addressing challenges and opportunities offered by SSH in agriculture, forestry and rural areas.

Figure 41. Panel discussion.

The **first question** posed to panellists was where they saw possible social, societal, behavioural challenges to adapt to the changing context in agriculture, forestry and rural areas. **Mark Redman** welcomed the increasing expansion and integration of the SSH into Horizon work programmes, and that there is scope for this trend to continue. However, he also

[11] Source: Report Integration of social sciences and humanities in Horizon 2020, published on 22 December 2020 https://research-and-innovation.ec.europa.eu/knowledge-publications-tools-and-data/publications/all-publications/integration-social-sciences-and-humanities-horizon-2020_en

sees **the need for a more nuanced discussion between the '*what*' SSH themes need to be addressed and the '*how*' SSH can be applied to enhance the effectiveness of R&I projects**. According to him this includes three needs: a deeper understanding of the dynamics of stakeholder engagement in an agri-food/forestry/rural context, developing better tools for the meaningful and impactful functioning of the science-policy, science-society and science-society-policy interfaces, and last a much fuller understanding of the challenges of communicating with "harder-to-reach" stakeholders.

Erwin Wauters confirmed that any Farm to Fork Strategy related target, whether it is on organic, pesticides, climate or antimicrobials, will require changes in farmer's and other actors' behaviour. A key challenge is to better understand those behavioural changes and the how to stimulate those changes. **For many challenges, technical solutions exist but we lack the private and public strategies to stimulate their adoption: SSH can help to better understand what strategies can work better.**

Karen Fabbri highlighted that all actors involved should be considered, not only the farmer and the producer, but also the citizen, the consumer. Changing consumers behaviour is challenging. The transition to sustainable and resilient food systems requires everyone to change, from the farmer to the processor, the retailer and the consumers. **R&I in behavioural economics is needed to come up with smart solutions that are attractive and effective to nudge citizens into more sustainable choices.**

The **second question** asked to panellists was about their perception and experience about how efficient we are in integrating a SSH perspective in EU R&I activities**.** Erwin Wauters pointed out that, although Horizon has been more efficient in integrating the SSH perspective in R&I projects for many global challenges and related research needs, the question should be reversed. Thus, **SSH should be at the core of the project concept, structure and architecture, and natural sciences should be integrated into that concept.** He found that the approach to foster SSH so far has been good, for example mainstreaming the multi-actor approach (which kind of facilitates integration of social scientists into project) and how project calls are designed (for instance by asking for systemic approaches and integration of SSH). The EU has as such been a pioneer through Horizon that inspired other funders and programmes. However, he noted that these efforts should continue during proposal evaluation and project evaluation, as it still happens too often that projects are granted that include multi-actor approaches, systemic approaches and SSH perhaps without assessing their full integration in the project.

Mark Redman noted that his experience to-date is on the implementation of the "multi-actor approach", and the integration of the principles and practice of Responsible R&I (RRI) into the text of specific topics needs to be fostered.

Karen Fabbri noted that the transition to sustainable food systems is predominantly a social issue, hence the human dimension and the integration of SSH is crucial. For example, SSH also includes the influence of media including social media, where food has become a dominant topic and is impacting our relationship with food. We have plenty of good examples of EU-funded projects, where we explore how to address behavioural change by using smart tools and approaches (e.g. FoodCLIC, Strength2Food), but **we need more efforts to ensure a just and equitable transition where no one is left behind**. She highlighted that the candidate Horizon Europe *Partnership on sustainable food systems for people, planet and climate* identifies the societal acceptability of the need to shift towards sustainable diets as one the main levers for food system transformation, often related to the food environment with the clear need for integrating SSH.

"For many challenges that Horizon Europe aims addressing, the question should not be 'how to better integrate SSH research in R&I projects', but rather making SSH the core of the project concept, structure, and architecture. Natural sciences should be integrated into that concept, not the other way around."- Erwin Wauters

Co-creation of R&I needs

The last part of the breakout session aimed at exploring, with the approximately 50 participants that joined, the opportunities offered by SSH in R&I to deliver on the current challenges of the EU agricultural, forestry and rural sectors (Figure 42).

This co-creation exercise was framed around 8 themes, with participants discussing two questions:

- What the SSH R&I needs are in those themes?
- How should those needs be delivered through R&I activities?

Figure 42. Co-creation in BO8

The main findings on SSH R&I needs per theme and how to deliver those are presented below:

Theme 1: Risk preparedness/resilience

- Need to understand how to convince stakeholders, including farmers, to implement measures addressing future threats (for instance linked to climate events or loss of biodiversity).
- Need to estimate the economic impacts of extreme climatic events: economic research could allow assessing the cost of actions and comparing to the costs of non-action.
- Preparing future generations (for example with specific school/university courses) in order to adapt to any unforeseen future event with global impact.
- For the how, there are opportunities to create new business models, enhance monitoring and advisory services. Also, foresight R&I should involve farmers more, and R&I should be linked to practice via living labs.

Theme 2: Attractiveness of the sector (issues related to e.g. age, gender, newcomers, agricultural workforce)

- Understanding the attractiveness of rural areas. Connecting SSH with living labs can be helpful. Also learning from international experiences that could be applicable to the EU.
- Need to know more about the workforce in agroforestry. Will there be people working in the future in the sector? What about their salary? What about their characteristics/profiles? Is there a difference in sectors? All this having in mind the attractiveness of the sector. To deliver on this, workshops, mapping, observatories and surveys to gather info and data over a long period of time.
- Connect the attractiveness of the sectors with the perception of citizens and consumers. Importance to foster social recognition of individuals in the sector and understand how this relates to attractiveness. To deliver on this communication tools can be important.
- Identify relevant socio-economic aspects and new skills (e.g. business, marketing) is important to reduce "uncertainty and negative perception" of potential newcomers.

Theme 3: Decision-making (how to encourage behavioural changes of farmers/foresters?)

- Distinguish SSH approaches based on different farming systems and farm sizes. This may influence decision making processes, including differences in relation to the actor who in fact has the decision making role. SSH R&I on decision-making mechanism in particular in the growing share of non-family farms, and so better understanding how to encourage behavioural change. To achieve these results, it was proposed to include ownership data and decision-making in the farm accountancy data network (FADN). Also, building thematic networks.
- Understand what kind of information farmers need to change their practices towards more environmentally friendly ones and how do farmers define "benefit". This can be delivered via "panels of users" that validate solutions, through living labs, thematic networks, and observatories on the quantity and quality of results.
- Need to understand what happens in value chain segments other than the farm (e.g. input supply, processing, retail). R&I actions should use the multi-actor approach, involving also farmers and other actors in experimentation, via surveys or through "game" approaches.
- Explore how decision making at the farm level is influenced by decision making at the landscape level & vice versa.

Theme 4: New types of farming

- Understand the drivers inside and outside the farm to move towards new types of farming: what motivates, what drives change, what is valuable for farmers, but also consumers and the whole society (e.g. social recognition, political and economic processes, safety of the business (resilience), contribution to a healthy environment, succession).
- Tools to improve communication of why specific farmers chose to transition to new types of farming.
- Basic research to assess the reasons why farmers choose to engage in new farming methods opposed to those who stay within the status quo. Tools that can be used include focus groups to exchange views, problems and solutions at farm type levels and territorial levels (from local to international).
- SSH disciplines such as sociology, history and anthropology can help understanding how farmers interact with their context and current needs based on history (e.g. farmer generations).
- Educational tools for consumers on aspects that affect farmers' work (e.g. seasons of the food).

Theme 5: well-being of farmers and foresters

- Development of a European-wide well-being framework would need mapping and common indicators. SSH can help to fill the gap of knowledge and evaluate the success of policies affecting farmers/foresters. This could be achieved with the use of different SSH disciplines through R&I actions focused on data collection, experimentation or living labs.
- Further understanding of drivers of behavioural change in relation to uptake of new (environmental) agricultural practices by farmers and foresters. Coordination actions with multi-actor approach could help identifying drivers.
- Understanding the local perception of workers in the agricultural and forestry sectors (sometimes considered as social workers). To achieve this, Research and Innovation Actions would be the most efficient way.
- Engage in R&I the relevant stakeholders beyond the "usual suspects", nudging the "harder-to-reach" actors such as small and medium farms/forests. Also need to better understand the different needs based on the geography and demography.
- Understand how factors such as climate change or democratic processes are impacting farmers and foresters' well-being and their decision-making.

Theme 6: Forestry

- Understanding motivations of forest owners for managing forests by exploring community management models and analysing the lessons learned.
- Knowledge on how to deal with the needs and high expectations of society toward forest-owners. SSH can facilitate change of society perception and discourses on forests/forestry.
- Gaining better knowledge of the forestry sector (ownership, forest workers, ageing, education level).
- Understanding of the socio-economic barriers to more environmentally friendly forest management.
- Analysing the political/institutional framework of forestry, and how the multifunctional and integrated forest management can deliver on the transition to a sustainable (circular) economy and society.
- Operational groups and Living Labs could be most adapted tools to foster co-creating R&I. This should involve all actors including forest owners and foresters but also citizens and users.
- These needs should be delivered through: cross sectoral research (collaboration of forestry /social science/economic research); co-creation of research – to bring researchers and society groups together (forest owners/users/citizens); value creation – taking existing knowledge from different areas (forestry, social science, humanity, economics, etc.) and creating sustainable solutions.

Theme 7: Climate change

- R&I on how to effectively communicate about climate change effects and solutions.
- SSH disciplines required are psychology, arts, education, communication.
- R&I should address the transition phase (i.e. mitigation, adaptation, systemic approaches) to enhance the communication from and towards all actors involved (researchers, citizens and policymakers).
- R&I projects should bridge different expertise by ensuring a adequate presence of SSH disciplines (including behavioural science) in the preparation of the project consortium, in their evaluation

phase (right experts), and finally involving all relevant actors during all phases of the project. Living labs can be a relevant tool in this context.

Theme 8: Citizen and consumer expectations

- Tools to nudge actors towards more sustainable diets and behaviours (e.g. with the use of behavioural psychology).
- Understand how to increase citizens' and consumers' awareness concerning the effort that farmers are making for biodiversity, environment and climate, and on the "true" cost and prize of agri-food products.
- Leverage behavioural psychology in R&I activities. Co-designing with local consumer groups "retail lighthouses" which offer food environments with new foods that incentives the healthy and sustainable choice. Fostering more connection and collaboration between retailers and the rest of the supply-chain is needed. Living labs could be developed in different EU countries, based on available R&I results and working together with retailers in a multi-actor approach.

Main findings from the breakout sessions

Tamsin Rose, Director of Tamarack SPRL and Senior Fellow at the Think Tank 'Friends of Europe', invited the keynote speakers of the breakout sessions to share **key messages "on the spot" from the breakout sessions** (Figure 43 and 44).

Figure 43. Keynote speakers shared key messages 'on the spot' from the first four breakout sessions.

Martin Kováč presented the findings of **BOS1 on Sustainably managed natural resources for agricultural production and the EU Mission "A Soil Deal for Europe"**:

- The session discussed that in the context of land and plants, **water and soil are key for production and biodiversity**. There is a need to **move from sectoral to integrated nexus approaches**, fostering circular economy: soil-water-energy-food production-ecosystems nexus. This can benefit delivering on SDGs.
- Main messages:
  - **Need for harvesting and assessing monitoring data** for integrated management of water, soil and crops.
  - Action is needed on **soil for climate adaptation**, good management practices, improve water retention and foster farming approaches that are regenerative.
  - **Motivation is crucial**, with right support to key stakeholders: farmers and foresters. Key to promote practices to update and recover soil and landscape, with the Mission Soil providing support.

Guy Richard presented the findings of **BOS2 on Agrobiodiversity for healthy cropping systems**:

- The session addressed the context of how to promote sustainable cropping systems.

- Main messages:
  - Need for **integration and a holistic approach with four dimensions**: relevant scientific disciplines (natural sciences and SSH), scales (from plant to EU levels), actors (top down and bottom up, including public-private partnership) and values within the value chain (production, marketing and consumption).
  - **Evaluate impacts, trade-offs, benefits and risks**: include **evaluation of the impact of 'non action'**, of action and the long-term assessment integrating historical aspects, the transition, risks and climate change.
  - Need to communicate and to **capitalise knowledge**.

Frédéric Leroy presented the findings of **BSO3 on Challenges and opportunities for healthy and sustainable livestock systems**:

- The session addressed livestock systems in tension with global challenges: need to deliver nutrition and be sustainable.
- Main messages:
  - **There is not a single 'livestock system'**: there are intensive, extensive, mixed systems. Important factors are breeds, genetics and dietary change.
  - Livestock has **several impacts** on human health, food and nutrition security, animal health and welfare, environmental aspects, rural communities, economics/livelihoods.
  - **How to navigate positive and negative externalities livestock?** Need for criteria for modelling, develop new business models and 'reality checks' via e.g. living labs.

Robert Mavsar presented the findings of **BOS4 on Sustainable management for multifunctional forests**:

- The session acknowledged that **forest deliver multiple roles towards environmental, social and economic sustainable models** in Europe. Opportunities to create and communicate new knowledge, considering the "big divide" of society: protection vs. use of forests. Need to contextualise within megatrends, the bioeconomy, resilience and biodiversity.
- Main messages:
  - **Co-create knowledge** all actors equal footing.
  - **Take up and use knowledge** created by key actors and support them.
  - Maintain and sustainably use knowledge after projects' end.
  - Researchers need fostering the multi-actor approach.

Figure 44. Keynote speakers sharing key messages 'on the spot' from the last four breakout sessions.

Bertin Martens presented the findings of BOS5 on **Digital and Data technologies in agriculture, R&I for sectoral transformation:**

- The session looked at data regulations in EU and how they affect farms and farmers. The Data Act opens access to farm data across the entire agriculture and food value chain, with opportunities for using data in a wide range of new services. The Data Governance Act opens up the possibility to set up trusted intermediaries for use of data, so farmers find trusted ways to share data.
- The main message is the **innovation opportunity to create a common agriculture data space** so researchers and policymakers can access, which will depend on data governance rules for engagement and use.

Emilia Schmitt presented the findings of BOS6 on **Rural opportunities**:

- The session acknowledged the **diversity of rural areas, difficult to define what are rural areas**: there is a continuum from cities to rural, with rural in Europe very diverse: no one solution fits all.
- Main messages:
  - **Innovation is place-dependent**, and smart technologies have to be smart for users beyond technology.
  - People and demographic challenges are probably most pressing aspect for rural areas: need to attract people that remain for sustainable development.
  - Many possibilities from governance, R& and other instruments. **Living labs and participation is crucial,** with the need to integrate more local rural people in decision making, with democratic processes considering new decision mechanisms.

Anikó Juhász presented the findings of BOS7 on **Bridging the gap between R&I and practice, tools and skills for today's and future generations:**

- The session looked into **how to help farmers for the twin digital and green transition**, from the policy, research and farmers themselves' perspective.
- Main messages around **four tools**:
  - Importance of the knowledge reservoir and its link with networks.
  - Make the multi-actor approach stronger in existing projects and develop it for better use.
  - Make better use and combination of **place-based innovation tools**.
  - **Skills are crucial**: need for 'champion farmers' that can be trusted by other farmers and show this to society.

Kristina Blennow presented the findings of BOS8 on **Social Sciences and Humanities for resilient and sustainable agriculture and forestry**:

- The session deepened on the **role and opportunities of SSH** in R&I on agriculture, forestry and rural areas.
- Main messages:
  - More scientific knowledge and its use for sustainable development is needed, where **SSH can contribute to better understand what is stopping actors** (farmers, foresters, consumers) from behavioural change. SSH can also help **to reach individuals for the sustainability transition.**
  - SSH is needed to **deliver the full potential of the systems approach**, that includes the individuals. This will support effective evidence-based policies and communication.
  - Overall, SSH helps society moving towards sustainable development.

Concluding remarks by the European Commission

Tamsin Rose gave the floor to the General Directors of the European Commission for Research and Innovation and for Agriculture and Rural Development.

Marc Lemaître, Director General for Research and Innovation of the European Commission (Figure 45), highlighted the need to address the planetary emergency. There are many challenges that justify the planetary emergency: water scarcity and water pollution, negative trend in wildlife and loss species. He acknowledged the crucial importance of soil for food security, where 95% food depends on soils.

There are three imperatives for making a difference and being fast when addressing the planetary emergency: provide continuous research efforts delivering new solutions, design research with a systems approach to deliver systemic changes, and finally embrace SSH in R&I to go beyond the technology focus. He called on the need to involve farmers, citizens and be ready to embrace change and to find opportunities to innovate in our democratic society.

Marc Lemaître concluded by stressing the role of R&I as a key contributor to solving the planetary emergency and acknowledged the need to strengthen collaborations to deliver on a healthy planet, a sustainable economy and happy and healthy citizens.

Figure 45. Marc Lemaître, left, and Wolfgang Burtscher, right, delivering the concluding remarks of the 2023 AgriResearch Conference.

Wolfgang Burtscher, Director General for Agriculture and Rural Development of the European Commission (Figure 45), started by thanking the participants onsite and online and the speakers for the rewarding perspectives and ideas discussed during the two days of the conference.

Wolfgang Burtscher highlighted the crucial importance of R&I in agriculture, forestry and rural areas: while food security and sustainability can be seen as incompatible, there is no choice. This is because we need to have food security in a sustainable manner, with R&I being key to achieve those two objectives at the same time. He stressed that, as heard all throughout the conference, R&I needs to be done with and for farmers. He recalled a quotation from Gilles Saindon, Assistant Deputy Minister for Agriculture, Canada: "the (innovation) work is not finished until innovation is on the hands of the farmers". Changes in agricultural practices and developing new skills take time, and pilot projects can deliver solutions for challenges. However, the greater challenge is that these solutions need to reach the 9 million farms of the EU, where all farmers should have access to them.

R&I also plays an important role for policy making, from the conception to the implementation and evaluation of policies. He noted the synergies between Horizon Europe and the CAP, which is an excellent example for breaking silos. There is a need to measure what agricultural policies can achieve: R&I can help by being holistic and implementing a systems approach. The example of livestock was noted, where all livestock-related sustainability aspects (environmental, social and economic) need to be taken into account also in R&I when supporting policymaking.

Wolfgang Burtscher closed the conference by thanking the team organising the event and again all the participants and speakers that gathered for this crucial event to discuss about the future of R&I in agriculture, forestry and rural areas.

Signing of the 'Soil Manifesto'

Following the closing speeches, **Kerstin Rosenow**, Head of Research and Innovation in the Directorate General for Agriculture and Rural Development, presented the EU Soil Manifesto for signature by Marc Lemaître and Wolfgang Burtscher (Figure 46).

Figure 46. Ceremony of the signature of the Soil Manifesto by Marc Lemaître and Wolfgang Burtscher.

The Mission Soil Manifesto aims to bring regional and local policy-makers, stakeholders and citizens together into a vibrant community that cares for soil health. It aims to foster local knowledge, innovation and investment by raising awareness that in order to protect our soils we must strive for more. Signatories of the document will recognise the need for action for soil health and will be able to engage in activities for improving soil health. They will have access to the latest research results, along with the opportunity to take part in knowledge sharing activities and events to exchange best practices for our soils.

We invite you to join the growing community and sign the Mission Soil Manifesto here!

Conference complementary content

EU Mission "A Soil Deal for Europe" – International cooperation with the Bill and Melinda Gates Foundation

Soil degradation as a global concern for citizens, international organisations, public and private entities was at the center of a conversation between **Magda Kopczynska**, then Deputy Director General of the Directorate General for Agriculture and Rural Development of the European Commission, and **Neil Watkins**, Deputy Director in the Global Policy and Advocacy division of the Bill & Melinda Gates Foundation (Figure 47).

Magda Kopczynska emphasised the international dimension of the EU Mission "A Soil Deal for Europe": not only the Mission is highly relevant to achieving the Paris Agreement and the Sustainable Development Goals, but it is also a major tool for the EU contribution to AIM for Climate, the Agriculture Innovation Mission for Climate launched at the COP26 in Glasgow. Cooperating with Africa on soil health is a priority area for the European Union, under the long-term partnership with the African Union on Food and Nutrition Security and Sustainable Agriculture (FNSSA).

Neil Watkins highlighted the Gates Foundation's commitment to investing in agriculture R&I to improve soil health and stressed the need to join forces to harness all the tools and technologies that can contribute to healthier and more productive soils in the EU and in Africa. He announced the Gates Foundation's intention to collaborate with the European Commission around the priorities set out under the EU Soil Mission, for instance by building on innovative research designs that involve local farmers in line with the EU living labs approach - such as the CGIAR's Excellence in Agronomy program or the CGIAR's 1000 Farms project.

The session closed on the Leonardo Da Vinci's quote *"We know more about the movement of celestial bodies than about the soil underfoot".* The EU Mission Soil and the international commitment to improve soil health are a huge opportunity to fill at least partially this knowledge gap in the current decade (Figure 47).

Figure 47. Discussion between Neil Watkins and Magda Kopczynska on international cooperation, moderated by Tamsin Rose

Message from the Save Soil global movement

Sadhguru, leader of the Save Soil global movement (Figure 48), addressed the Conference participants with an inspiring take-home message through a pre-recorded video, highlighting the EU leading role in promoting soil health worldwide and the key role of farmers. Sadhguru signed the Mission Soil Manifesto and invited all the participants and those following online to do the same.

Figure 48. Sadhguru sharing an inspiring take-home message and signing the Mission Soil Manifesto.

An artist impression of the 2023 AgriResearch Conference

The visual artist **Sven Retoré** captured the essence of the discussions held during the conference as presented below and in the next pages (Figures 49 to 53).

Figure 49. First plenary session: High level opening on R&I enabling sustainable transition in agriculture, forestry and rural areas.

Figure 50. Second plenary session: Sustainable Development Goals, are we on track for 2030? What's next?

Figure 51. Third plenary session: R&I enabling farmers, foresters and rural communities to become more resilient, sustainable and climate smart.

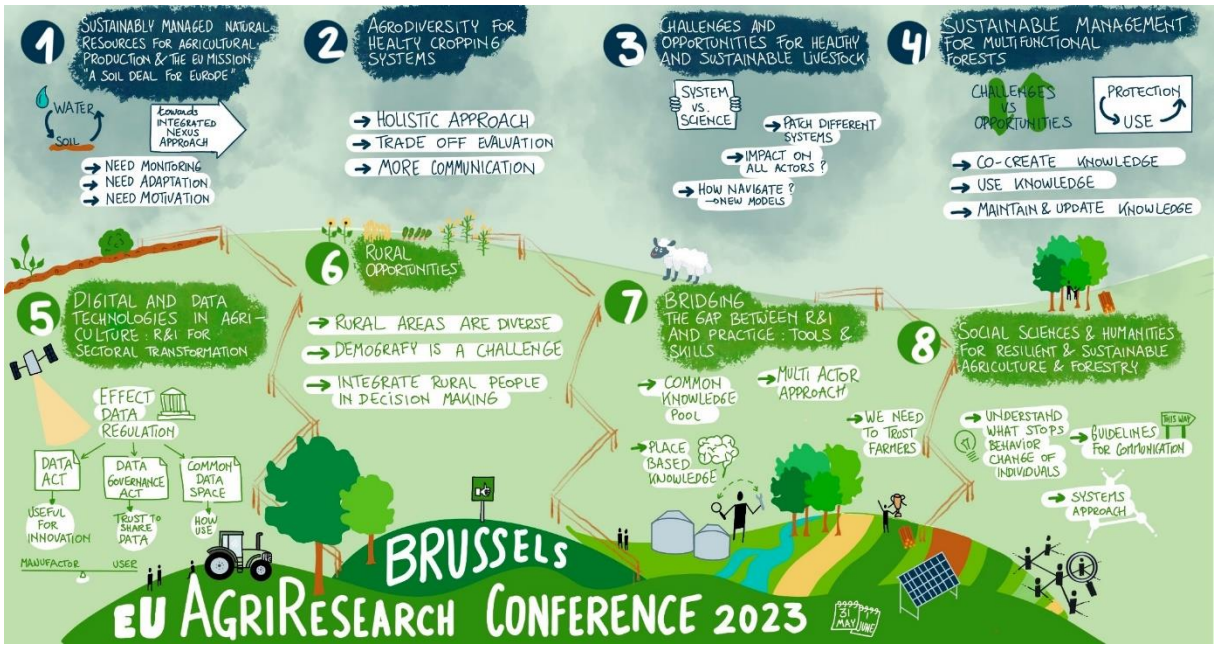


Figure 52. Reporting 'on the spot' from the breakout sessions.

Figure 53. Closing session and complementary content.

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